

AIR WAR COLLEGE

AIR UNIVERSITY

BEYOND THE TASK FORCE CONOPS:  
THE PATH TO A CAPABILITIES-BASED  
MODERNIZATION FRAMEWORK FOR THE AIR FORCE

by

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## *Preface*

Defense modernization programs are governed by a labyrinthine array of interacting decision processes. Senior DoD leaders face an incredibly difficult task in deciding what projects are worth pursuing, and how much money should be spent on them. My assignments with the Air Staff and the National Security Space Architect introduced me to the complexity of these decision processes. While it was fascinating to see how they work, the experiences led me to ponder why a clear unifying context so often seemed absent, and whether prioritization efforts could benefit from more analytical discipline or “rigor.” The Strategy and Technology program at Air War College provided an opportunity to research the relevant issues and develop ideas for improvements. With the chief of staff’s vision for Task Force CONOPS now becoming a linchpin of Air Force modernization strategy, two broad research questions took shape: Are the new CONOPS-based initiatives on the right track? What should be done to maximize their chances of success? I hope that my analysis and recommendations will help readers appreciate the driving issues and the opportunities for beneficial changes to Air Force and DoD practices.

I would like to thank Gen John Jumper, Dr. Alexander Levis, Maj Gen Dan Leaf, Brig Gen(S) Michael Snodgrass, Col Richard Tedesco, Col Evan Hoapili, Col Robert Gordon, Col John Hyten, Col Doug Owens, Mr. Bob Preston, and Dr. Paul Davis for their gracious interviews and many helpful comments supporting this project. Mr. Preston provided extremely useful reference material, as did Ms. Elaine Grossman. Insights and comments from Mr. Ted Hailes and Col Fred Cheney of the Air War College faculty were also appreciated. I especially wish to



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## *Abstract*

The chief of staff has articulated a vision for the future of Air Force modernization planning, based on a family of effects- and capabilities-based “Task Force Concepts of Operations.” The initiative is slowly gaining momentum as a new “Capabilities Review and Risk Assessment” process takes hold to link program and resource decisions to the desired operational capabilities. Despite the promising start, the new approach must likely be enhanced significantly if it is to evolve into an effective “control system” for modernization. The Air Force must cope with pressures and “boundary conditions” imposed by DoD’s transformation priorities, joint architectures and interoperability policy, spiral acquisition policy, and some directed reorganizations. In order to manage these and leverage them favorably, the Air Force must resolve difficult issues involving stovepipes, misalignment, and lack of accountability in current processes and organizations, and shortcomings in the quality and completeness of information available for planning and decision-making. The paper suggests several alternative approaches for resolving these issues, and assesses them systematically against issue-driven criteria. The results point to a “composite alternative” (drawing best features from the candidates) as the ideal course of action for building an effective modernization framework. The recommended framework emphasizes better architectural definition of Task Force concepts, the need to manage program portfolios in an integrated manner, the importance of aggressive concept innovation within broad strategic guidelines, and the need for a pervasive and common assessment mechanism to facilitate horizontal and vertical integration across both Air Force and

joint processes. These enhancements could be critical enablers for developing agile, adaptable, and networked capabilities needed to succeed against tomorrow's increasing security challenges.

# Part 1

## Introduction

*The centerpiece of this effort is the development of new Task Force Concepts of Operations (CONOPS) that will guide our planning and programming, requirements reform, and acquisition.*

— General John Jumper, *Chief's Sight Picture*

The chief of staff of the US Air Force (CSAF) has directed that a family of effects-based Task Force CONOPS be created. These CONOPS will provide a new unifying context for Air Force strategic planning, requirements development, and programming activities—with particular emphasis on guiding the funding priorities for acquisition and technology investments. CONOPS development is the centerpiece of Air Force activity supporting DoD's initiatives to “transform” the military and transition from a program-centric focus to one based on capabilities and effects.<sup>1</sup> CONOPS-driven activities are designed to permeate the Air Force's key corporate processes and spur widespread changes within them; but has the Air Force created the conditions for success? This paper argues that while the emerging Task Force approach is promising, it will need significant enhancements if it is to become an effective “control system” to drive Air Force modernization efforts. The arguments are based on a systematic analysis of driving issues and challenges, and an assessment of alternative approaches for resolving those issues. Results from the assessment point to a recommended course of action for building an enhanced modernization framework upon the emerging foundation of the new Task Force initiatives.

The path to a comprehensive framework of adequate depth, breadth and alignment will be difficult. CONOPS-based efforts are attempting to gather momentum amidst a number of formidable, competing pressures within DoD and the Air Force. The Task Force efforts must recognize these pressures and proactively work to leverage them. The CONOPS themselves will need strengthening and depth; top-level vision statements are not enough to effectively organize change. More importantly, the CONOPS-driven activities need to be well structured, and linked horizontally and vertically to a number of interacting processes, actors and products in a manner that provides an adequate “architectural” organizing framework. It must be reasonably comprehensive in providing guidance to processes and organizations that impact requirements, acquisition, planning and programming, and architecture development. The framework should describe capabilities in a structured hierarchy that highlights interdependencies, while empowering concept-level innovation. It should include disciplined, traceable, analytical mechanisms sufficient to guide decisions and prioritization efforts in a consistent, repeatable manner. Until this comprehensive framework is outlined and communicated, stakeholders will not grasp the “big picture” of the CONOPS-driven approach and its associated linkages. Consequently, it will be unlikely that requirements, programs, technology investments, and related actions (in organization, staffing, education, and training) will be consistently prioritized in a rational manner, at all levels within the Air Force.

### **Driving Forces**

There are several concurrent driving forces and themes for change within the defense environment that help compel the CONOPS initiative, and that will be impacted by it. This makes implementation a complex challenge.

First, Air Force and joint planners have increasingly emphasized desired *effects* as the most legitimate basis for operational planning, requirements development, and identification of needed capabilities.<sup>2</sup> Effects-based thinking seeks to understand the linkages between actions, resulting effects, and the contribution of those effects toward achievement of military or political objectives. The intent is to think beyond attrition-based warfare and target lists to provide better rationale for military actions and the capabilities needed to perform them. A key role of the Task Force CONOPS will be to document a baseline set of effects that the Air Force intends to be able to achieve in future operations.

Second, DoD guidance from the Quadrennial Defense Review (QDR) and annual Defense Planning Guidance has emphasized the need for transformation and called for a shift from threat-based to capabilities-based planning and programming.<sup>3</sup> A capabilities-based approach seeks to prepare for a full spectrum of plausible threats rather than designing force structure to handle a few specific adversaries and scenarios. It also addresses military capabilities more in terms of “what jobs need to be done?” than in terms of “what can be done with specific platforms or programs?” Broad, effects-based CONOPS provide a means to elucidate needed effects and capabilities without undue focus on specific scenarios or platforms. Air Force planners hope that this shift in emphasis will stimulate operators and developers to find innovative new ways to marry operational concepts, organizational structures, and technologies for air and space systems—marriages that would be synonymous with the “transformational” changes envisioned in DoD guidance.<sup>4</sup>

Third, DoD and Air Force programmers are attempting to implement capabilities-based rationale in the annual Planning, Programming, and Budgeting System (PPBS) cycle. The goal is to provide sound, capabilities-based criteria that can be used to evaluate and prioritize

programs for funding decisions. DoD established top-level criteria by defining “transformation goals” in the QDR report.<sup>5</sup> The Task Force CONOPS provide an AF viewpoint of those strategic and transformational priorities, and are thus an appropriate reference point to guide AF prioritization efforts. The Air Force’s new process for assessing its overall portfolio of acquisition programs, the Capabilities Review and Risk Assessment (CRRA), is using the Task Force CONOPS to gauge the contributions of particular programs toward the capabilities to achieve desired effects.<sup>6</sup> The CRRA results (and the subjective judgments of Task Force experts) will help shape AF programming decisions.

Fourth, DoD continues to emphasize the needs to reform acquisition processes and stabilize programs. There is strong interest in better equipping the warfighter with timely, innovative, and integrated solutions. To do so, the preferred approach is to design incremental or “spiral development” programs that can deliver phased improvements in capability with manageable risks and costs at each step.<sup>7</sup> Recent updates to DoD policies have also emphasized the need to integrate requirements and acquisition programs within a framework of “joint integrated architectures.”<sup>8</sup> The Task Force CONOPS and associated CRRA process should help the Air Force to identify useful increments of capability, as well as to gauge the degree to which integration and interoperability concerns need to drive particular acquisition programs.

Fifth, Air Force and joint leadership have begun to insist that the traditional requirements process begin with a firm foundation in CONOPS. The chairman of the Joint Chiefs of Staff (CJCS) and the Joint Staff recognize the importance of operational concepts and architectures in the logic flow that connects strategy to systems.<sup>9</sup> Changes to the joint requirements generation system are in work to minimize the likelihood of stove-piped requirements and solutions.<sup>10</sup> The Task Force CONOPS will likely be featured in a parallel Air Force initiative to strengthen

requirements logic. Requirements developers intend to use Task Force CONOPS and capabilities as foundations for candidate solutions and system-level CONOPS, which would then underpin the development of system requirements.<sup>11</sup>

Finally, the Air Force is making fundamental changes in the ways it organizes and trains its workforce to carry out its missions. Air and Space Expeditionary Task Forces and the rotational Air and Space Expeditionary Force (AEF) construct were established in the late-1990's as the AF approach to preparing, tailoring, and presenting forces for Joint Task Forces in the post Cold War security environment.<sup>12</sup> General Jumper has challenged the entire Air Force to align with the AEF rhythm. These changes are tied directly and indirectly to the Task Force CONOPS. The direct linkage is through the AEF CONOPS—an overarching CONOPS describing the AEF rotational rhythm and other “foundational” capabilities that underpin the AEF and the six mission-oriented Task Forces.<sup>13</sup> The indirect links may be just as important. These CONOPS will become part of the foundation for future doctrine, guiding wargames, experiments, and exercises to validate new organizational and operational constructs. The Task Force CONOPS will also influence guidelines for developing future leaders and airmen, who will be expected to “think across systems” rather than in program- and platform-centric stovepipes.<sup>14</sup>

Thus, Task Force CONOPS are being introduced at the nexus of an assortment of driving pressures for change. If implemented successfully, these CONOPS will generate the “connective tissue” between the Air Force’s future effects-based operational vision and the corporate processes that prioritize, fund, acquire, and present capabilities for the warfighter. That is clearly the chief’s vision. However, success is not a “given”—the interrelationships among the various corporate processes are intricate. Many issues must be addressed to get all the actors and



processes to work together harmoniously and efficiently. Today, few formal controls are in place to ensure that programs and resources are accurately aligned with strategic priorities; decision-making tends to be stove-piped and heavily reliant on subjective judgments of senior leaders. Can these issues be resolved by a CONOPS-driven approach? Will the new Task Forces provide the right amount of control and objectivity, while breaking down stovepipes that inhibit today's processes? These questions cannot yet be answered. It is first necessary to answer the following, more fundamental research questions of this paper: (1) What are the driving issues with the current modernization process, and why? (2) What changes or enhancements would best address particular issues? (3) Which of these ingredients should be included in a "comprehensive" modernization framework? (4) What specific steps should be taken to evolve today's processes into such a framework?

## **Organization and Research Approach**

To answer these questions requires careful definition of the dimensions of the problem, a thorough analysis of driving issues, and a comparative assessment of alternative solutions to suggest specific recommendations. This paper is structured with the following organization:

- The paper first describes the current "baseline" corporate approach, to establish a reference point for issues and a foundation for potential enhancements. It highlights developments that brought the approach to where it is today, including DoD's strategic direction to pursue capabilities-based planning and transformation. The emerging roles of CONOPS-driven activities are also outlined.
- Next it describes the additional DoD-wide "pressures" that drive change in the current defense modernization environment. These include pressures to: define capabilities in terms of desired effects; enforce architectures, integration, and interoperability; better align strategic priorities with resource allocation; improve acquisition management and requirements development; and implement specific defense reorganizations. All are important, so a comprehensive modernization framework will need to account for the pressures, align them favorably, and resolve any issues that could undermine success.
- These "driving" issues are then detailed from the perspective of how and where they impact (or could impact) the baseline Air Force approach.

- The paper then suggests an outline for an idealized modernization framework that would align with DoD-wide pressures and resolve the main issues. The emphasis is on scope rather than details: a summary listing of activities required to effectively link top-level strategic objectives to an integrated portfolio of programs and technology. This “scoping model” may not be achievable in the near term, but it helps illuminate a complete set of evaluation criteria that can be used to grade any proposed, realistic framework.
- Next, several alternative frameworks are proposed as candidates for assessment. Each alternative presents a different “vector” for change—a plausible theme and approach that focuses on resolving a particular subset of the driving issues. The alternatives include variants on the “baseline” and also leverage existing concepts for “comprehensive frameworks” presented elsewhere in the literature. Ideas from both government-oriented and “industry best practice” approaches are considered.
- The paper then conducts an assessment of the alternative vectors in terms of the evaluation criteria already developed. The assessment identifies the preferred alternatives and their best features, leading to a “composite alternative” and a set of recommendations for implementing it. This alternative captures the recommended path toward a comprehensive, capabilities-based modernization framework.

The research approach included a search for existing methodologies for resource allocation and portfolio management, a comparison of those methods in the context of current pressures, and a survey of different viewpoints on the major issues and ways to address them. Interviews were conducted with key personnel in the Air Force corporate processes, including the chief of staff. Because the CONOPS-driven approach is still in its first few cycles, the emphasis was on gathering and evaluating a range of ideas for longer-term strategic enhancements, rather than on criticisms of the new approach at the “tactical level.”

## Part 2

### CONOPS-Driven Modernization: The Current Approach and Status

*The USAF is leading DoD's effort to transition from a program-centric focus to one based on capabilities and effects.*

— General John Jumper, *Chief's Sight Picture*

Current processes for Air Force modernization planning, programming and execution are governed by formal DoD and Air Force policy directives and instructions, statutes, and other senior leadership directives. Examples include DoD's long-standing Planning, Programming and Budgeting System (PPBS), DoD acquisition policy as captured in the "5000 series" instructions,<sup>15</sup> requirements management policy described in CJCS instructions, Title 10 authorities for Service roles in training, organizing, and equipping, and the recent CSAF direction on Task Force CONOPS and CRRA.<sup>16</sup> These policies and processes do not always fit together seamlessly. The PPBS, acquisition management "system," and requirements generation "system"—considered to be the three major "decision support systems" within DoD resource management—are largely independent.<sup>17</sup> The processes co-exist with a certain balance of power and authority in shaping DoD programs. Of the three, PPBS is most dominant. This chapter outlines the current Air Force approach to planning, programming, and portfolio management to set a context for the Task Force initiatives and potential enhancements.

## **Legacy Approach for Planning and Programming**

The current “baseline approach” to Air Force modernization is built on a decentralized strategic planning and programming process that constitutes the legacy Air Force approach to PPBS and requirements development.<sup>18</sup> Air Force major commands (MAJCOM) do most of the work in this process to translate strategic goals into the “nuts and bolts” of the annual Program Objective Memorandum (POM). Appendix A describes the “integrated planning process” used at Air Force Space Command and Air Force Special Operations Command. Though mission area plans are broadly shaped by top-down guidance from DoD, the Air Force, and combatant commanders, the MAJCOMs and their commanders have flexibility to define POM “themes” and conduct tradeoffs to arrive at POM program content and funding recommendations.

Headquarters USAF builds the integrated Air Force POM by consolidating the MAJCOM submittals, and making additional AF-wide adjustments and tradeoffs where necessary. Functional or mission-centric “panels” play a key role in this process. Chaired by Air Staff colonels, these panels (and their supporting integrated product teams) analyze and integrate the MAJCOM portfolios in order to strengthen funding arguments and suggest minor adjustments. The panel chairpersons become the lead programmers, advocates and subject matter experts for their mission/functional portfolios as they move through the remainder of the POM development cycle. The POM is reviewed and adjusted by successively higher levels of multi-functional “corporate board”—the one-star level “Air Force Group,” two-star level “Air Force Board,” and four-star level “Air Force Council” (chaired by the vice chief of staff). Finally it goes to the chief of staff and secretary of the Air Force for final review and approval.

When the Air Force POM is submitted to the Office of the Secretary of Defense (OSD) along with other Service and agency programs, the overall portfolio is again assessed and

adjusted “on the margins” in OSD’s program and budget reviews. These form the latter stages of the PPBS cycle, leading to the annual President’s Budget submitted to Congress. OSD analysts and issue teams recommend changes based on inputs from the CJCS and Joint Staff, defense guidance and overall DoD priorities, Congressional pressures, unpaid warfighting “bills,” and other factors. Their viewpoints are weighed against Service arguments, and ultimately, the secretary of defense or deputy secretary make decisions on key programs and funding issues.

To provide the Air Force leadership with a depth of insight into the health of programs and their operational utility, a regular series of acquisition portfolio reviews has also been conducted. These reviews were previously called “Quarterly Acquisition Program Reviews” (QAPR); each QAPR covered the suite of programs in a broad functional/mission area such as fighters, mobility, or space. The QAPR was an overall “vector check” and status review that summarized each program’s issues or risks in areas such as requirements, CONOPS, cost, schedule, and performance; and sometimes examined crosscutting issues across programs. QAPRs were not directly tied to PPBS or acquisition management. They served to inform the chief of staff and secretary of the Air Force on program status and issues, and generated various action items—but did not often impact program funding or milestone decisions that fall within the purview of the PPBS or acquisition system. They also did little to show the relative importance of each program in meeting DoD’s strategic guidance and objectives.

### **New DoD Strategy: Transformation and Capabilities-Based Planning**

“Transformation” emerged as a consistent theme of defense policy in the Bush administration, initially emphasized in the QDR report and recently reinforced in the National Security Strategy.<sup>19</sup> Transformation has been defined and interpreted in various ways, but the Air Force working definition is “a process by which the military achieves and maintains

advantage though changes in operational concepts, organizational structure, and/or technologies that significantly improve our warfighting capabilities or ability to meet the demand of a changing security environment.”<sup>20</sup>

The QDR established six “critical operational goals” to provide the focus for DoD transformation efforts. These identify challenges such as protecting bases of operation, assuring information systems, projecting US forces into anti-access environments, tracking and engaging critical targets, enhancing the capability and survivability of space systems, and developing an interoperable, joint C4ISR architecture.<sup>21</sup> Concepts or programs that address these six challenges have a better chance of being judged as “transformational.” While it remains a matter of opinion as to whether a program is transformational or not, transformation clearly involves combinations of new operational concepts, new technologies, new ways to integrate forces, new or innovative uses of existing capabilities, and changes in military leadership, organization, training, and doctrine.<sup>22</sup> Fortunately, the concept becomes a bit more concrete when considered in the context of another central theme of the QDR—that of capabilities-based planning.

The QDR emphasized the need to “shift the basis of defense planning from a ‘threat-based’ model that has dominated thinking in the past to a ‘capabilities-based’ model for the future. This capabilities-based model focuses more on how an adversary might fight rather than specifically whom the adversary might be or where a war might occur.”<sup>23</sup> The capabilities-based approach is seen as being intimately tied to transformation. Like transformation, opinions differ about what it means and how to implement it. A recent monograph proposes an analytical architecture to carry out “capabilities-based planning,” based on the following definition:

Capabilities-based planning is planning, under uncertainty, to provide capabilities suitable for a wide range of modern-day challenges and circumstances, while working within an economic framework. Capabilities-based planning is only part of defense planning more generally, which can be seen as an exercise in portfolio management. The

marginal dollar may be spent, for example, to increase or improve force structure, weapon platforms, homeland defense, overseas presence, leverage of allies, research and development (R&D), or transformation-related advanced prototyping. All are important, but tradeoffs must be made.<sup>24</sup>

This viewpoint chooses to emphasize “capabilities” that relate to the uncertainty of future threats and environments, and the need to consider a broad range of plausible scenarios in order to deduce a sufficiently robust set of capabilities to deal with that uncertainty. It does not ignore specific threats, but instead emphasizes a “design space” where tradeoffs are made instead of a set of bounding “point scenarios” that formed the basis for legacy planning (e.g., the Two-Major Theater War scenario).<sup>25</sup> Arguably, the QDR vision of capabilities-based planning is simply threat-based planning using a more robust definition of plausible threats.

A more compelling “flavor” of the capabilities-based mindset is the one emphasized by the chief of staff, namely to move away from a program- and platform-centric mentality, and to first ask, “What needs to be done, and what capability is required?” General Jumper described the motivation this way:

What I’m trying to get away from is the old paradigm which says we start with the big bumper sticker, “Global Vigilance, Reach and Power,” and then the next slide you see is the programs. We’ve grown up in this very program- and platform-centric world, such that even the major aerospace companies are organized by platform. There’s nothing that starts with what you’re trying to do, there’s no concept of operations that describes how you’re going to fight, how you’re going to fit together with your coalition and joint partners to go win the war, before you start talking about what you’re going to go buy to fight with.<sup>26</sup>

Both flavors of capabilities-based thinking are consistent in their focus on achieving desired effects to accomplish challenging missions. They differ however in their perspectives on the importance of an uncertain future threat. The AF viewpoint does not emphasize a large range of scenarios, instead maintaining that the threat can be aggregated to a few “hardest tasks” that will drive required capabilities.<sup>27</sup>

When Dr. Stephen Cambone took over the DoD Office of Program Analysis and Evaluation (PA&E) in July 2002, he described his intent to implement the capabilities-based approach within the program and budget process; and specifically to create the “connective tissue” between strategy guidance, programs, and budget. Cambone said the office would use the QDR transformation goals as measurements to evaluate programs, and outlined three focus areas for the evaluation: capabilities-based approach; contributions to joint operations; and strategic choices that avoid the typical decision approach made program by program, platform by platform.<sup>28</sup> The first and third of these thrusts are clearly compatible with the Air Force response to the QDR—and are virtually synonymous in the AF lexicon.<sup>29</sup>

Thus, DoD and Air Force leaders are demanding capabilities-based thinking, and have outlined broad notions of what that concept should mean. What *does* it really mean? What should a capabilities-based approach look like? There is no easy answer—and in fact, this is the central research question of the paper. However, a preliminary idea of the *scope* of a capabilities-based approach can be outlined here, drawn from a number of “comprehensive frameworks” that have already been proposed to implement some form of capabilities-based planning. These include two RAND efforts—Davis’ framework for “mission-system analysis,”<sup>30</sup> a CONOPS-oriented framework proposed by Kent and Ochmanek<sup>31</sup>—as well as a Navy approach derived from ideas of Network-Centric Warfare.<sup>32</sup> An overview of these and other conceptual frameworks is included in Appendix A. While they take different viewpoints on capabilities-based reasoning, some general features can be identified. The schemes tend to (1) identify the overall set of DoD or Service missions to be addressed; (2) partition these into manageable subsets or elements—either by mission or sub-mission within an appropriate hierarchy—and highlight “challenging” missions that deserve particular attention; (3) use a



modular, building block approach to construct “complete” capabilities for each mission element or challenge; (4) include mechanisms to integrate the building blocks, and analyze their individual and collective merits; (5) use the results of those integration and assessment efforts to identify gaps and overlaps in capability; and (6) use those gaps and overlaps to drive programming priorities and resource decisions.

The “emerging” Air Force planning and programming approach—that is to be driven by Task Force CONOPS and associated “capability reviews” (CRRAs)—can be seen as another, albeit embryonic, variant of this type of capabilities-based planning framework. The next section outlines ongoing changes in the Air Force corporate approach as it adapts to the capabilities-based pressures and begins to display the “common features” noted above.

#### **Air Force Initiatives: Toward a CONOPS-Based Corporate Approach**

The Air Force has introduced its own strategy for transformation and capabilities-based thinking. It categorizes transformational activities into three major areas: new technology, new operational concepts, and new organizational structure.<sup>33</sup> Efforts in each area can be mapped onto the QDR transformation goals.<sup>34</sup> The Task Force CONOPS are seen as the building blocks of the “new operational concepts” pillar of Air Force transformation—and they are intended to shape and influence the other two pillars.

At CSAF direction, these Task Force CONOPS were initiated in Fall 2001 at the Air Staff, and later assigned to MAJCOMs for further development and sponsorship. Each development effort was, and continues to be led by a “Task Force Champion”—an Air Staff colonel with appropriate mission expertise.<sup>35</sup> Most CONOPS are “co-owned” by an officer from the responsible MAJCOM staff. Task Force CONOPS are described in terms of a white paper or

briefing that can be accessed from the CONOPS website.<sup>36</sup> The approved list of Task Force CONOPS includes:

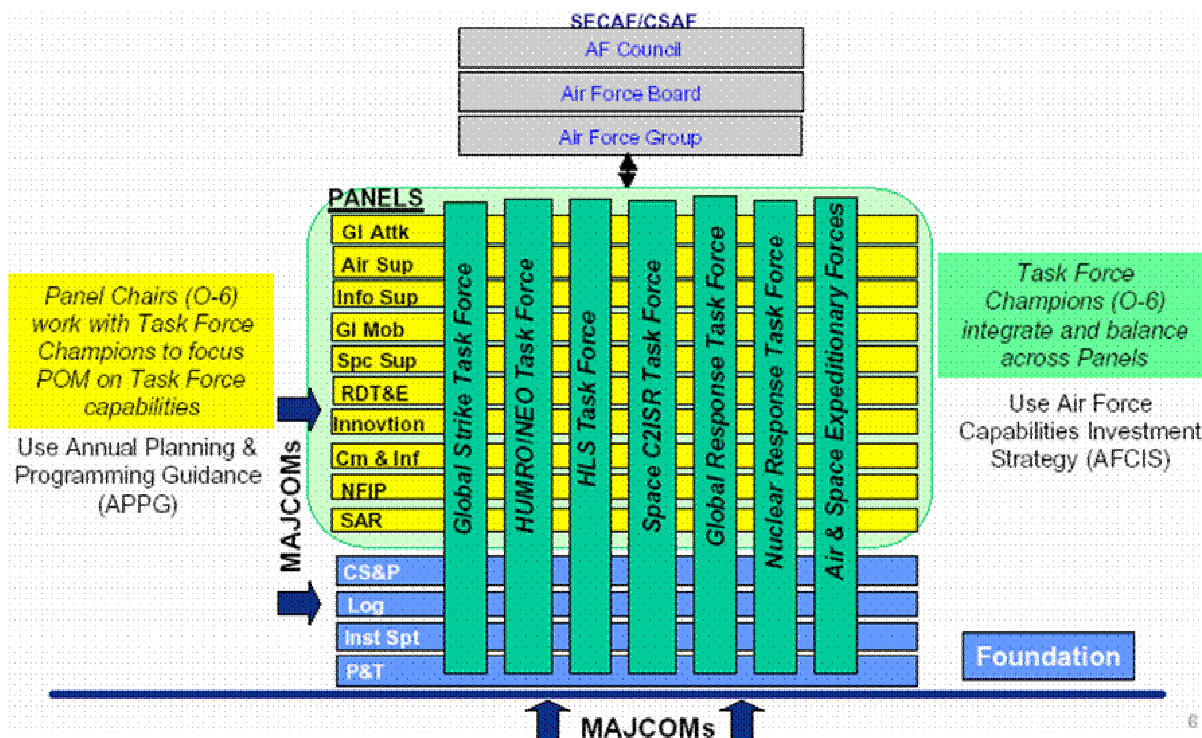
- Global Strike Task Force
- Homeland Security Task Force
- Global Mobility Task Force
- Space and C4ISR Task Force
- Global Response Task Force
- Nuclear Response Task Force
- Air and Space Expeditionary Force CONOPS.

In the CSAF's words, the Global Strike Task Force is a concept to "go against the toughest problem we have," while the other Task Forces tend to be lesser included cases but which "describe the other toughest tasks we think we're going to have."<sup>37</sup>

In addition to setting up these Task Force CONOPS to provide vision for future operational capability needs and requirements, the Air Force expects them to drive a shift in the focus of traditional corporate processes away from "platforms and programs," and onto desired warfighting effects, and the capabilities needed to create them.<sup>38</sup> The chief of staff directed that the Task Force CONOPS be woven into the fabric of the corporate process, to serve as filters and evaluation aids for corporate decision-making. The metaphor is appropriate, because the suggested implementation placed the Task Force Champions into a matrix arrangement with the O-6 panel chairpersons, to review and assess MAJCOM POM submittals (Figure 1).<sup>39</sup> The Champions would, in principle, guide the POM on a conceptual par with the panel chairs and provide a cross-cutting perspective and set of recommendations as to which combinations of programs should be supported in the corporate process—based on the perceived ability of the

programs to provide (fully or partially) capabilities outlined in the Task Force CONOPS.<sup>40</sup> Thus, programs and projects would have both functional/mission advocates and Task Force advocates in the corporate process. General Jumper’s vision evidently goes even further than this first “matrix implementation,” given his elaboration on this process:

And by the way, you give the money to the Task Force Champions, and they’re the ones that are saying “OK, these are the capabilities I have to have.” Now the program guys are down there saying, “you know, if he really needs this capability, it’s really a combination of this program and this program. So, let us go in together and try to sell the Task Force Champion on this.” Now you’re combining programs in useful packages that result in overall capabilities.<sup>41</sup>



Source: Woodward, “USAF Interoperability” Briefing (2002)

**Figure 1. Task Forces and the AF Corporate Structure**

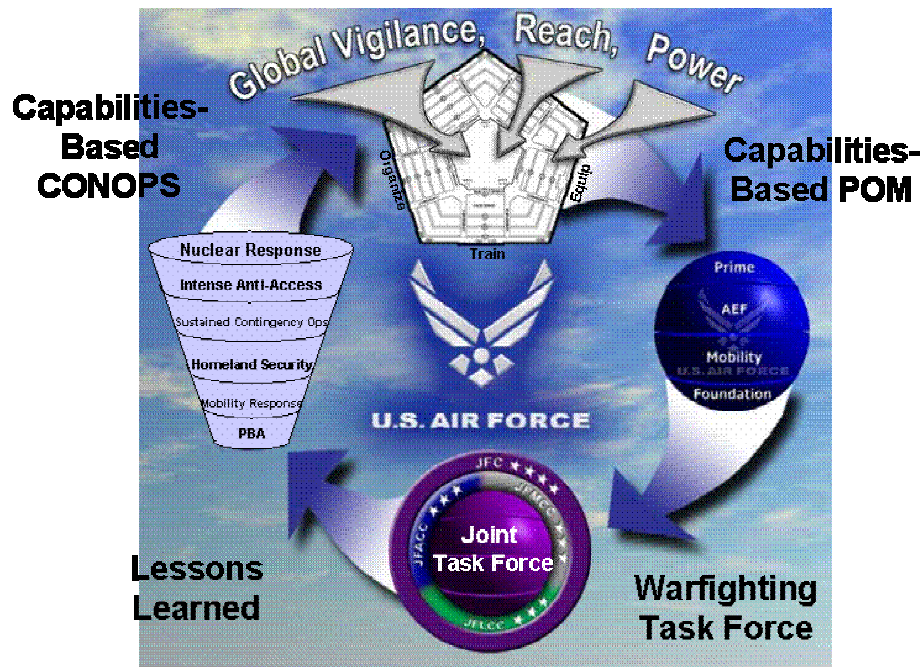
To provide a depth of insight into CONOPS-driven progress and priorities, regular acquisition portfolio reviews are still being held. However, the former Quarterly Acquisition Program Review (QAPR) process has been replaced by the Capabilities Review and Risk

Assessment (CRRRA)—intended to be an overall review of acquisition programs from the perspective of supporting each Task Force CONOPS. In evolving from QAPR to CRRRA, the emphasis changed “from a program review to a review of how our programs contribute to warfighting capabilities and effects.”<sup>42</sup> The CRRRA is intended to inform the leadership about gaps, overlaps, and priorities in programs’ support to Task Force capabilities.<sup>43</sup> The process of building the CRRRA package is currently at the heart of the Air Force methodology for connecting CONOPS to programs and technology. Maj Gen Dan Leaf, the AF lead for CRRAs explained that “the intellectual framework from the CONOPS is not sufficient for decision-making, you’ve got to go through the Capabilities Review and Risk Assessment to really put meat on the bones.”<sup>44</sup> Briefly, this CRRRA process (1) starts from the CONOPS-defined scope of the Task Force mission—the list of desired effects, and capabilities required to create them; (2) describes each capability in terms of a breakout of elements, functions, and attributes needed to do the job; (3) identifies programs and technology that support each capability; (4) assesses risk in terms of gaps or weaknesses in the capability over time, and in terms of gaps and overlaps in supporting elements or programs; and (5) summarizes the overall risk, issues, and recommendations for each capability.<sup>45</sup>

The Air Staff articulates an overall vision for Air Force capabilities-based planning in the manner depicted in Figures 2 and 3. Figure 2 shows the CONOPS-to-capabilities translation process (the “Pentagon” in the figure) as part of an ongoing cycle of presenting forces to Joint Force Commanders (via Air and Space Expeditionary Task Forces). It begins by incorporating lessons learned from previous joint operations, using Air Force CONOPS to determine needed capabilities, and then continuing the cycle through the programming process. Figure 3 gives the

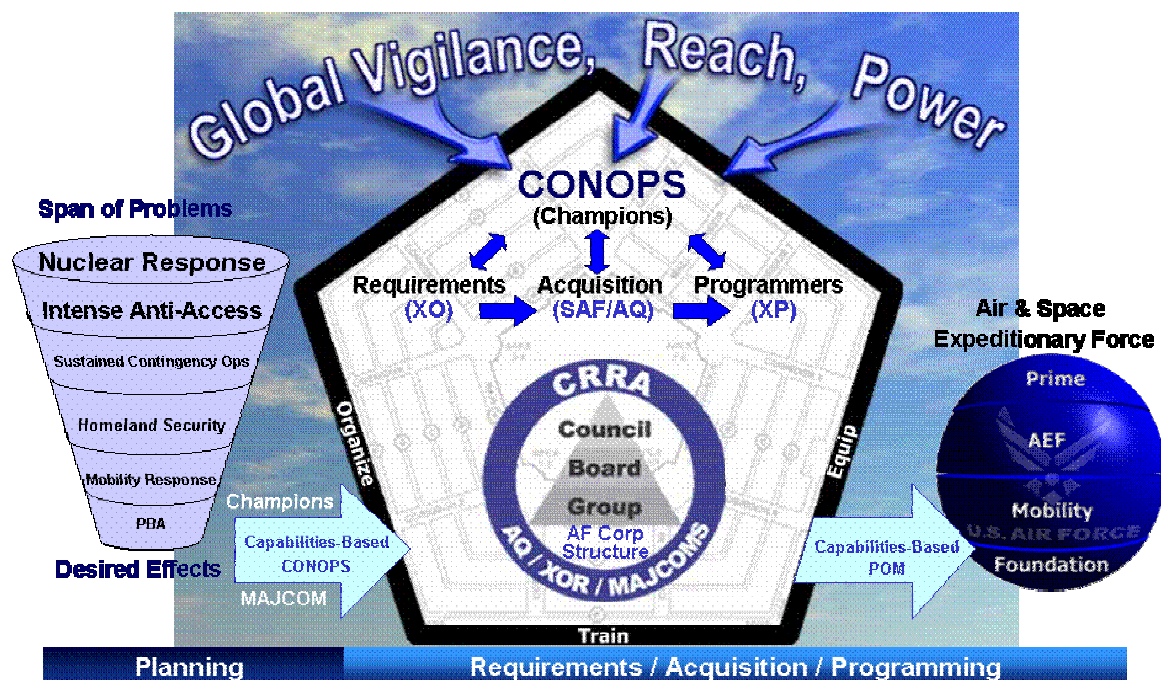
notional Air Force viewpoint on the details “within the Pentagon,” as corporate processes interact with the new CRRA to link CONOPS to programmed capabilities.<sup>46</sup>

Unfortunately, the Fiscal Year 2004 POM cycle was executed with very little change from the traditional Air Force process. Draft Task Force CONOPS were becoming available, but most were still “in work” during the heart of the key MAJCOM and HQ USAF programming efforts. Likewise, Task Force Champions were available to participate in the corporate deliberations, but were not given a central role nor were they able to drive widespread changes or adjustments to priorities. Only one CRRA, the Global Strike Task Force, had been completed by June 2002. The Space and C4ISR CRRA was completed in late 2002, and other CRRAs are



Source: HQ USAF, “Task Force CONOPS Roadshow” Briefing (2002)

Figure 2. Capabilities-Based AF Strategy



Source: HQ USAF, "Task Force CONOPS Roadshow" Briefing (2002)

**Figure 3. CONOPS to Capabilities Translation**

slowly getting under way. CRRAs are grappling with issues of scope, coverage of crosscutting functional capabilities (like space or information operations), and methodology to link programs to capabilities. Maj Gen Leaf uses an acquisition phase analogy to summarize the status:

Global Strike Task Force CRRA ... went very well for being the first one ... (and) was a "concept demonstration" CRRA. The second one, Space C4ISR CRRA was our "prototype." Now we're in "limited rate initial production," and that's about where we are. The CONOPS continue to mature, and the CRRA process continues to mature. They're maturing well, and I'm really happy with it. As I said, it's very difficult. We've got to get that piece more correct before we have direct interaction with the corporate structure.<sup>47</sup>

Consequently, the current Air Force plan is to "roll out" the Task Force-driven structure partly in the FY05 Amended POM process and fully in the FY06 POM build.<sup>48</sup>

In the meantime, the HQ USAF has established a full-time Task Force Champion organization and staff under the Directorate of Operational Requirements. Officers in the new organization are working to solve various implementation issues including: (1) how to phase the

CRRAs with the POM build, so the CRRA can be used to “grade” MAJCOM POM submittals; (2) how to make the “capability assessment” a living document after the CRRA concludes; (3) how to perform assessments on capabilities spread over many Task Forces—like tankers; (4) how to develop a common scorecard and methodology, while preserving some flexibility in individual CRRAs; and (5) how to get MAJCOMs better plugged into the process.<sup>49</sup>

Is the CONOPS-driven approach working? The evidence to date is mixed, but it is surely too soon to tell. In addition to the sluggish start, ample skepticism remains inside and (especially) outside the Pentagon, and a plethora of issues need to be worked through (to be discussed in Chapter 4). However, there is enthusiasm for the approach. Programmers appreciate the potential value of the Task Forces in helping to identify candidate offsets and trade space, and to establish priorities and decision criteria.<sup>50</sup> For instance, the Global Strike Task Force Champion was able to provide tie-breaking advice to a panel debating a major offset during recent budget reconciliation activities, based on the CONOPS and capabilities lay down built in the CRRA.<sup>51</sup> Even skeptics acknowledge that the capabilities-based initiative has already changed the language used to begin programming debates; they now begin with “what capability are we talking about here, and what are the options to get it?”<sup>52</sup> Senior leaders remain cautiously optimistic. General Lester Lyles, Commander of Air Force Materiel Command, says, “it’s the right thing to do,” but that “the jury is still out” on how well the approach will ultimately work.<sup>53</sup>

In summary, the strategic pressures to transform and shift to capabilities-based planning focus attention on “critical” mission challenges, innovative operational concepts, new and innovative uses of technology (where appropriate), and a building block approach to creating flexible and agile forces. It drives the need for “systems thinking” and a comprehensive, integrative framework for modernization planning. The shared characteristics of existing

conceptual frameworks and the new Air Force approach, are that they attempt to carve missions up into a manageable number of driving subsets (e.g., the Task Forces), use CONOPS as the basis for designing integrated “capability packages” to address those mission subsets, frame investment strategies and acquisition decisions based on these integrated packages or portfolios rather than by particular platform or program, and have means to assess the value of both the component parts and the overall packages toward reducing operational risks (both near-term and future). In a rudimentary way, the Air Force appears to be touching most of the right bases with its CONOPS and CRRA efforts. However, there are many differences among candidate capabilities-based approaches (in emphasis, scope, processes, and actors), and many issues to be resolved across these dimensions. Moreover, the turbulent defense modernization environment is bringing other important pressures to bear that will help drive the success or failure of any candidate framework. The “bigger picture” of these competing pressures needs to be understood in order to fully grasp the issues and to properly assess alternatives to suggest the “right” capabilities-based approach for the Air Force.

#### Notes

<sup>1</sup> Gen John P. Jumper, chief of staff, US Air Force, “Chief’s Sight Picture: Capabilities Review and Risk Assessment,” 11 February 2002, n.p., on-line, Internet, 25 September 2002, available from [http://www.af.mil/lib/sight/sight\\_11feb02.pdf](http://www.af.mil/lib/sight/sight_11feb02.pdf); and “Chief’s Sight Picture: Corona Top 2002,” 10 July 2002, n.p., on-line, Internet, 8 November 2002, available from [http://www.af.mil/lib/sight/sight\\_corono02a.pdf](http://www.af.mil/lib/sight/sight_corono02a.pdf).

<sup>2</sup> Air Combat Command, “Effects Based Operations,” ACC White Paper (Langley AFB, VA: ACC/XP, May 2002), 1-26; Maj Gen David A. Deptula, USAF, “Air Force Transformation: Past, Present, and Future,” *Aerospace Power Journal* (Fall 2001), 13 August 2001, n.p., on-line, Internet, 23 October 2002, available from <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj01/fal01/phifal01.html>.

<sup>3</sup> Department of Defense, *Quadrennial Defense Review Report* (Washington, DC: Office of the Secretary of Defense, 30 September 2001), iv, on-line, Internet, 11 July 2002, available from <http://www.defenselink.mil/pubs/qdr2001.pdf>.

<sup>4</sup> Col Robert Suminsby, HQ USAF/XPXT, “The Air Force Transformation Flight Plan (FY03-07)” (briefing presented at Air War College, Maxwell AFB, AL, 24 October 2002), 7-14.

<sup>5</sup> Linda D. Kozaryn, “Program Analysis, Evaluation Office Implements New Approach,” *DefenseLINK News* (Washington DC: American Forces Press Service, 19 July 2002), n.p., on-line, Internet, 14 December 2002, available from [http://www.defenselink.mil/news/Jul2002/n07192002\\_2002071910.html](http://www.defenselink.mil/news/Jul2002/n07192002_2002071910.html). QDR priorities form the basis of more specific DoD guidance provided in annual Defense Planning Guidance, Program Decision Memoranda, and (draft) Transformation Planning Guidance.

<sup>6</sup> Gen Jumper, “Chief’s Sight Picture: CRRA,” n.p.



## Notes

<sup>7</sup> Deputy Secretary of Defense, memorandum for Secretaries of the Military Departments et al., subject: Defense Acquisition, 30 October 2002, Attachment 2, “Operation of the Defense Acquisition System,” 4, on-line, Internet, 14 December 2002, available from <http://dod5000.dau.mil>.

<sup>8</sup> Ibid., 2-3; DoD Instruction (DoDI) 4630.8, *Procedures for Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)*, 2 May 2002, 25-28.

<sup>9</sup> CDR Mike Mara, “Integration and Interoperability through Operational Concepts and Architectures” (briefing presented at the 2002 DoD Interoperability Conference, Mesa, AZ, 26 March 2002), 4-5, on-line, Internet, 14 December 2002, available from <http://www.dtic.mil/ndia/2002interop/mara.pdf>.

<sup>10</sup> Maj Gen James A. Hawkins, vice director, Joint Staff, memorandum, DJSN-0921-02, subject: Changes to the Requirements Generation System, 7 October 2002, on-line, Internet, 14 December 2002, available from <http://dod5000.dau.mil/3170%20memo.pdf>.

<sup>11</sup> Col Mark Budgeon, HQ USAF/XORD, “Operational Capability Requirements” (briefing, Washington DC: HQ USAF/XORD, 30 January 2003), 14-15. This continues a trend observed during the author’s assignment in the Directorate of Operational Requirements at HQ USAF in 1999-2000. The AF Requirements Oversight Council (AFROC) expected an effects-based CONOPS to be in place as a prerequisite to reviewing proposed requirements documents. Note, the AFROC has been renamed as the “AF Requirements for Operational Capabilities Council” (AFROCC) to reflect the new capabilities-based emphasis. See the requirements management web site at <http://www.afreqs.hq.af.mil/afrocc.htm>.

<sup>12</sup> Air Force Doctrine Document (AFDD) 2, *Organization and Employment of Aerospace Power*, 17 February 2000.

<sup>13</sup> Col George Duda, AEF CONOPS Champion, “Air and Space Expeditionary Force CONOPS” (briefing, Washington DC: HQ USAF/XOXS, October 2002), 7, on-line, Internet, available from AF CONOPS website at <https://afconops.hq.af.mil/support/index3.htm>.

<sup>14</sup> This implies a need for education and training in concepts of systems engineering, integration, and “architecting.” High-level CONOPS will also set a vision for how different functional areas should contribute to accomplishing the mission (or not), and what types of expertise and leadership skills are needed to develop and employ the capabilities.

<sup>15</sup> DepSecDef, Defense Acquisition. This memorandum cancelled the current DoD Directive 5000.1, DoD Instruction 5000.2, and DoD Regulation 5000.2-R. It issued interim replacements for the first two documents as attachments to the memo, and directed that the 5000.2-R document be used as an interim handbook until replaced.

<sup>16</sup> For example, DoD Instruction 7045.7, *Implementation of the Planning, Programming, and Budgeting System (PPBS)*, 23 May 1984; CJCS Instruction 3170.01B, *Requirements Generation System*, 15 April 2001; *Title 10 – Armed Forces, US Code*, chap. 803, sec. 8013 (1 February 2001), on-line, Internet, 25 Jan 2003, available from [http://uscode.house.gov/title\\_10.htm](http://uscode.house.gov/title_10.htm); DoD Directive 5100.1, *Functions of the Department of Defense and Its Major Components*, 1 August 2002; and Gen Jumper, “Chief’s Sight Picture: CRRA.”

<sup>17</sup> Although some key players, like the vice chairman of the Joint Chiefs of Staff, have roles in multiple aspects of the three decision support systems.

<sup>18</sup> “Legacy” is a bit of a misnomer, since the particulars of the corporate processes have changed frequently. A good overview of changes since the Goldwater-Nichols Act of 1986 is given by Leslie Lewis, Roger Allen Brown, and C. Robert Roll, *Service Responses to the Emergence of Joint Decisionmaking*, RAND Report MR-1438-AF (Santa Monica, CA: RAND, 2001), ix-xviii, 1-11, 61-79, on-line, Internet, 25 January 2003, available from <http://www.rand.org/publications/MR/MR1438/>.

<sup>19</sup> *QDR Report*, 29; President, *The National Security Strategy of the United States of America* (Washington DC: The White House, September 2002), 30.

<sup>20</sup> Suminsby, 7-12. The OSD working definition found in Department of Defense, “Transformation Planning Guidance (TPG)” (draft “Tank” briefing, Washington DC, 16 December 2002), is slightly different: “A process that shapes the changing nature of military competition and cooperation through new combinations of concepts, capabilities, people, processes and organizations that exploit our nation’s advantages and protect against our asymmetric vulnerabilities to sustain our strategic position...”

<sup>21</sup> *QDR Report*, 30.

<sup>22</sup> Suminsby, 13-14.

<sup>23</sup> *QDR Report*, iv.

## Notes

<sup>24</sup> Paul K. Davis, *Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation*, RAND Report MR-1513-OSD (Santa Monica, CA: RAND, 2002), 2-3, on-line, Internet, 18 November 2002, available from <http://www.rand.org/publications/MR/MR1513/>.

<sup>25</sup> Ibid., 11-12, 21-25.

<sup>26</sup> Gen John P. Jumper, chief of staff, US Air Force, interviewed by author, 18 December 2002.

<sup>27</sup> Ibid.

<sup>28</sup> Kozaryn, n.p.

<sup>29</sup> However, the question of joint or DoD priorities vs. Service priorities is a potential sticking point. The author's interviews with the CSAF and other AF programmers in December 2002 indicated that the PA&E-led program review for the FY04 programming cycle involved a large number of contentious issues, and a prodigious amount of OSD direction to the Services.

<sup>30</sup> Davis, xi-xxiv.

<sup>31</sup> Glenn A. Kent and David A. Ochmanek, *A Framework for Modernization*, draft RAND Project Air Force Report DRR-2629-1-AF (Washington, DC: RAND, June 2002), iii-vii.

<sup>32</sup> Cheryl Walton, "TST MCP Architectures, Assessments, and Interoperability" (briefing presented at the 2002 DoD Interoperability Conference, Mesa, AZ, 26 March 2002), 4-5, 11, on-line, Internet, 14 December 2002, available from <http://www.dtic.mil/ndia/2002interop/walton.pdf>.

<sup>33</sup> Deptula, n.p.

<sup>34</sup> Suminsby, 37-42.

<sup>35</sup> Elaine M. Grossman, "Air Force to Name Seven Colonels to 'Champion' Key Task Forces," *Inside the Pentagon* (21 February 2002), n.p., copy provided by author.

<sup>36</sup> At <https://afconops.hq.af.mil/support/index3.htm>.

<sup>37</sup> Gen Jumper interview.

<sup>38</sup> In a recent discussion at Air War College, an AF general officer noted that the Task Force CONOPS should be viewed as desired "buckets of capability" vice traditional operational concepts.

<sup>39</sup> Lt Gen Jack Woodward, "USAF Interoperability" (briefing presented at the 2002 DoD Interoperability Conference, Mesa, AZ, 27 March 2002), 6, on-line, Internet, 14 December 2002, available from <http://www.dtic.mil/ndia/2002interop/woodward.pdf>.

<sup>40</sup> Elaine M. Grossman, "Air Force Remodels Oversight Process for 'Capabilities-Based' Tack," *Inside the Pentagon* (11 April 2002), n.p., copy provided by author.

<sup>41</sup> Gen Jumper interview.

<sup>42</sup> Gen Jumper, "Chief's Sight Picture: CRRA," n.p.

<sup>43</sup> Elaine M. Grossman, "Air Force Creates New Process to Review Warfighting Capabilities," *Inside the Pentagon* (21 March 2002), n.p., copy provided by author.

<sup>44</sup> Maj Gen Daniel P. Leaf, Director of Operational Requirements, HQ USAF/XOR, interviewed by author, 18 December 2002.

<sup>45</sup> Headquarters US Air Force, "Space and C4ISR Capabilities Review and Risk Assessment: 4 Star Review" (U) (briefing, 30 October 2002), n.p. (Secret/NOFORN) Information extracted is unclassified.

<sup>46</sup> Headquarters US Air Force, "Task Force CONOPS" ("roadshow" briefing, 2002), 21, 23., on-line, Internet, 2 December 2002, available from <https://afconops.hq.af.mil/support/roadshow.ppt>.

<sup>47</sup> Maj Gen Leaf interview.

<sup>48</sup> "Way Ahead," AF CONOPS web site, on-line, Internet, 2 December 2002, available from <https://afconops.hq.af.mil/support/index3.htm>; also confirmed in interviews with Maj Gen Leaf, Col Evan Hoapili, Space Superiority Panel chair, and other HQ USAF programmers.

<sup>49</sup> Brig Gen(S) Michael Snodgrass, Deputy Director of Operational Requirements, HQ USAF/DXOR, interviewed by author, 18 December 2002.

<sup>50</sup> Col Evan Hoapili, chair, Space Superiority Panel, HQ USAF/XPPS, interviewed by author, 17 December 2002; Col Richard Tedesco, chief, Program Integration Division, HQ USAF/XPPE, interviewed by author, 18 December 2002. "Trade space" refers to a panel-identified set of programs (including candidate offsets) that are ranked close enough to a panel's funding cutoff line such that they may or may not deserve funding after further analysis; the trade space is elevated to the next higher level of corporate review (i.e., the Air Force Group), where assessments are made from an Air Force-wide perspective after closer scrutiny of specific issues. Issues that are too tough to decide in the Group comprise a trade space to be elevated to the AF Board, and so forth.

## Notes

<sup>51</sup> Maj Gen Leaf interview.

<sup>52</sup> Col Hoapili interview.

<sup>53</sup> Gen Lester L. Lyles, commander, Air Force Materiel Command, remarks at Air War College luncheon, 22 October 2002. General Lyles acknowledges that the CONOPS-driven CRRA process has some problems, but believes that the Air Force will get better at it in upcoming reviews. He identifies the driving question as being how well the existing PPBS processes will accept the new ideas.

## Part 3

### What Else is Important? Competing Pressures

*The major institutions of American national security were designed in a different era to meet different requirements. All of them must be transformed ... to focus more on how an adversary might fight rather than where and when a war might occur.*

*—President George W. Bush, The National Security Strategy of the United States of America*

Recent pressures have driven toward getting better military capabilities to the joint warfighter more quickly to meet increasingly difficult national security challenges. These include the pressures for transformation, effects- and capabilities-based thinking, CONOPS imperatives, and an expeditionary Air Force. The last chapter explained how these themes are shaping the new Air Force approach to modernization planning. However, they are not the only pressures to be reckoned with. This chapter discusses other high-visibility pressures for change, which give additional incentive for an improved corporate resource management process. Specifically, it discusses the DoD-wide pressures to

- Implement effects-based operations
- Pursue interoperability, integration, and architectures
- Prioritize limited resources based on strategic guidance
- Reform acquisition and requirements processes via evolutionary strategies
- Implement DoD reorganizations for space, homeland defense, etc.

Some of these systemic pressures will tend to push against each other to a certain degree, lessening the chance of clear-cut process solutions. More challenging though, is that they all need to overcome various political obstacles (Congressional, interagency, inter-Service, intra-Service, and with industry), bureaucratic inertia, and resource constraints for modernization.

### **Pressure to Implement Effects-Based Operations**

Air Force and joint planners have highlighted effects-based operations (EBO) as a new and desirable way to fight. They agree that desired *effects* should be the basis for operational planning, requirements development, and identification of needed capabilities. These ideas are not new, and were applied by the Air Corps Tactical School in developing the targeting strategies used in World War II. However, the military has not institutionalized this thought process sufficiently to ensure consistent adherence to EBO principles.<sup>1</sup> Various definitions of EBO are in use between the Air Force and DoD.<sup>2</sup> Among these, Air Combat Command defines EBO as “actions taken against enemy systems that contribute directly to desired military and political outcomes.”<sup>3</sup> Specific methodologies for EBO implementation are of more direct concern to operational planners than to modernization efforts. However, EBO pressures will influence the Air Force’s CONOPS-driven approach in two ways.

First, EBO is another impetus for Task Force CONOPS developers to become more sophisticated in their systems thinking and in describing innovative end-to-end concepts that combine and integrate building blocks to achieve effects. This goes beyond simply shortening the kill chain; it may change the perspective on what kind of kill is required, or whether a kill is even needed. The challenge of EBO is to identify causal links between actions (including those which the warfighter can take), resulting effects, and the contribution of those effects toward meeting strategic and operational objectives.<sup>4</sup> Of course, while some effects might be “complex”

outcomes from usage of multiple elements of power, others (especially at the operational and tactical levels) will remain more straightforward and traditional: destroy a target, rescue a crewman, or jam all communications.

Second, similar to transformation and capabilities-based ideas, EBO thinking injects yet more jargon, ambiguous definitions, and confusion into planning processes. A clear lexicon will be needed to define effects, effects-based, capabilities, and so forth. Task Force CONOPS are expected to be effects-based, but may struggle with definitional ambiguities. Confusion should be expected when effects are characterized both by “task list” verbs like provide, exploit, neutralize, deny, and destroy, and by “outcome-oriented” verbs like change, persuade, deter and halt—sometimes in the same process or document. This is not a new concern. While discussing a difficult space acquisition issue in early 2000, the secretary of the Air Force commented that “we need an effects-based CONOPS for space”—an idea that sounded sensible, but that left staff members puzzled afterward over what it would really mean. Defining an effects-based CONOPS obviously remains a challenge today.

### **Pressure for Interoperability, Integration, and Architectures**

Defense weapon systems and information systems continue to be plagued by limitations in joint interoperability. Though progress has been made as a result of increased attention over the last decade, DoD test authorities recently identified at least twenty major combat systems with significant interoperability shortfalls.<sup>5</sup> Thus, the trend toward increased scrutiny of interoperability requirements and testing will continue. The Joint Staff, Joint Requirements Oversight Council (JROC) and Joint Forces Command emphasize interoperability requirements for new combat systems as well as for modification and sustainment programs on current systems. Interoperability is a mandatory Key Performance Parameter, and an Information

Exchange Requirements (IER) matrix is to be included in all requirements documents as the primary basis and measure for systems interoperability.<sup>6</sup> Efficient derivation of IERs requires a well thought out operational concept and operational architecture (of which IERs are a subset).<sup>7</sup>

Further, DoD and joint instructions call for a systematic hierarchy of architectures to be developed to organize and ensure interoperability among joint systems. This emphasis can be traced to several DoD “science board studies” in the mid-1990’s that recommended the development of architectures as the basis of acquisition,<sup>8</sup> as well as to the Information Technology Management Reform (Clinger-Cohen) Act of 1996, which requires government agencies to thoroughly document their information management activities and to link business strategies to strategic system architectures.<sup>9</sup> These led to the creation of a set of “architecture frameworks” to be used for architecture development. In DoD, the so-called “C4ISR Architecture Framework” was issued in draft form in December 1997 and subsequently endorsed and mandated in February 1998 for all new C4ISR systems.<sup>10</sup> It has been renamed the DoD Architecture Framework, with a new version expected to be issued soon.<sup>11</sup> Related frameworks have been developed and used by federal enterprises as well as by a commercially oriented group.<sup>12</sup>

The idea of developing a DoD-wide “Joint Operational Architecture” gained momentum in the late 1990’s, partly driven by the C4ISR Framework and by lessons learned from operations in Kosovo.<sup>13</sup> The Joint Operational Architecture was envisioned to describe the totality of tasks and activities, operational elements, and information flows required to accomplish the missions of DoD.<sup>14</sup> The chairman of the Joint Chiefs of Staff, viewing the Joint Operational Architecture as a key mechanism to foster interoperability, issued direction to organize it around “Joint Mission Areas” and identified about a dozen “as-is” and “to-be” Joint Mission Areas.<sup>15</sup> Later,

DoD Instruction 4630.8 codified these ideas and others more formally; the key concepts are summarized in Appendix A. The joint architecture includes so-called “mission area integrated architectures”—each consisting of an operational, systems, and technical description of the family-of-systems or system-of-systems architecture for a focused mission area; for instance, Theater Air and Missile Defense.<sup>16</sup> The DoD instruction goes on to define the process for using mission area integrated architectures to define “capstone” interoperability requirements for systems-of-systems and their associated acquisition programs and requirements documents.<sup>17</sup>

DoD Components are directed to develop mission area integrated architectures consistent with the Joint Mission Areas and the overall Joint Operational Architecture. However, it is not a “given” that the Air Force’s Task Force CONOPS and CONOPS-derived capabilities are a good fit with the joint architectural framework outlined in Appendix A, or that the AF and joint processes will mesh smoothly. While there is some evidence of proactive cooperation at the action officer level,<sup>18</sup> leadership comments give a different picture. The current chairman expressed a view in June 2001, that the “broader, big-picture interoperability standards based on a joint operations concept and a joint operational architecture” are “better than the more limited set a Service’s well-intentioned, but nonetheless Service-centric view leads them to.”<sup>19</sup> Service chiefs understandably have a different view. General Jumper expressed skepticism about giving more responsibility to joint oversight mechanisms:

It’s called the JROC. And if the JROC did its business of defining the standards and the interfaces and holding the Services to them, we would be just fine. But ... the extent that we are not integrated, tells me that the JROC has not fully done that.<sup>20</sup>

The JROC and Joint Staff counter that they are best positioned to foster integration at the hub of the three decision support systems: requirements generation, acquisition management, and PPBS.<sup>21</sup> The chairman recognizes that operational concepts and architectures were “missing



links” in the old ways of connecting defense strategy to requirements and programs, and has directed the JROC to develop them to drive integration and transformation.<sup>22</sup> Meanwhile, both Air Force and Navy chief architects and integrators view themselves in similar roles at the juncture of requirements, acquisition, and PPBS.<sup>23</sup>

OSD and the joint community are apparently pursuing a new construct to drive the allocation of joint responsibilities for building operations concepts and integrated architectures. This construct (presented in the context of “transformation guidance”) involves the decomposition of “Joint Operating Concepts” into subordinate operations that are either “born-joint” or Service-led operations. Born-joint operations would be parceled to joint organizations to develop detailed CONOPS and integrated architectures; Service-led operations would be delegated for Service CONOPS and architecture development.<sup>24</sup> While the idea of born-joint capability packages could still face “significant institutional barriers,”<sup>25</sup> some form of top-level coordination and allocation of responsibilities makes sense. The Air Force needs to ensure that its framework for capabilities-based modernization meshes with the overarching joint framework for assessing “transformation goodness” and joint interoperability.

Compounding the confusion over architectural roles, it remains unclear whether Service *or* joint organizations are sufficiently empowered and capable to build mission area integrated architectures. This function was lacking in previous “capstone requirements” constructs—no one was clearly responsible for the top-level architecting and system engineering functions needed to design a family- or system-of-systems, define and integrate subordinate-level systems, and allocate requirements to them.<sup>26</sup> Another fundamental challenge is to architect and integrate “at the right level”—a level that provides sufficiently detailed guidance to enable integration while not getting bogged down in huge numbers of interface requirements. The AF chief

scientist notes that the “art” of working interfaces is to focus on the ones that don’t work; but efforts commonly strive to be exhaustive in documenting *all* interfaces and IERs.<sup>27</sup> In one example, a joint architecture was valuable, but an over-enthusiastic usage of the C4ISR Framework that resulted in 40,000 Information Exchange Requirements was not.<sup>28</sup>

For these and other reasons, DoD mission areas have been slow to embrace formal architectural frameworks. Though policy is basically in place, a senior DoD official described progress on Joint Operational Architecture and other architectures as being “insufficient” and on system-of-systems implementation as being “inadequate” in May 2001.<sup>29</sup> Some DoD mission areas are being specifically pushed to develop and enforce architectures, but others seem content to be “architecture-free zones.”<sup>30</sup>

Adopting a formal approach does have drawbacks. The C4ISR Framework (and forthcoming DoD Architecture Framework) requires that a number of specific products be developed within the operational, systems, and technical architecture views.<sup>31</sup> IER matrices can be enormous. The C4ISR Framework has thus been criticized for being overly cumbersome and product-intensive, with subtleties that are not sufficiently well understood by the using community to yield useful outcomes.<sup>32</sup> Also, it provides just one of many perspectives and tools that might be considered to describe an enterprise-level architecture.<sup>33</sup> More generally, the value of prescriptive architecture-driven planning has been questioned based on historical commercial evidence. One study found that “at no stage was architectural work seen to have any intrinsic value in its own right.”<sup>34</sup>

Disciplined architecture development will be hard, but there are compelling reasons to push it aggressively. First, it supports the chief’s initiative to enhance Air Force interoperability and capabilities by efficient digital integration among automated systems.<sup>35</sup> A new HQ USAF

organization, Warfighting Integration (HQ USAF/XI), was created in 2002 to lead these efforts. Their success will hinge on architectural discipline within AF mission areas, for as Sage and Lynch have noted, “Without very careful effort at developing an appropriate architecture for a system, there will be little hope of integration.”<sup>36</sup> Second, it will be crucial for understanding the collateral effects that changes in one element of a system-of-systems will have on other elements. If a system is cancelled, delayed, or scaled back, how will this impact other systems that interact with it? These cross couplings are very difficult to model or assess with confidence. It will be important to not only develop “architectural descriptions” of capabilities, but also the performance models of those networks and systems-of-systems to allow such linkages to be predicted with some rigor. HQ USAF/XI, and particularly the Air Force Studies and Analysis organization, would have the main responsibility to develop this type of analytical capability.

The pressures to improve interoperability and integration mean an emphasis on architectural standardization, discipline and control. This added discipline should not be a counterforce against innovation, efficiency, flexibility or completeness. To the contrary, the “building blocks” of capability, if interoperable with “integrable” data flows, can be individually optimized to address particular threats or missions, and still be assembled in various ways to support a range of activities—thus yielding a more flexible, complete, and efficient set of capabilities on the whole. Architectures must have an “open systems” viewpoint that manages broad roles and interoperability rules while allowing design flexibility and insertion of new technology.

### **Pressure to Prioritize Limited Resources Based on Strategic Guidance**

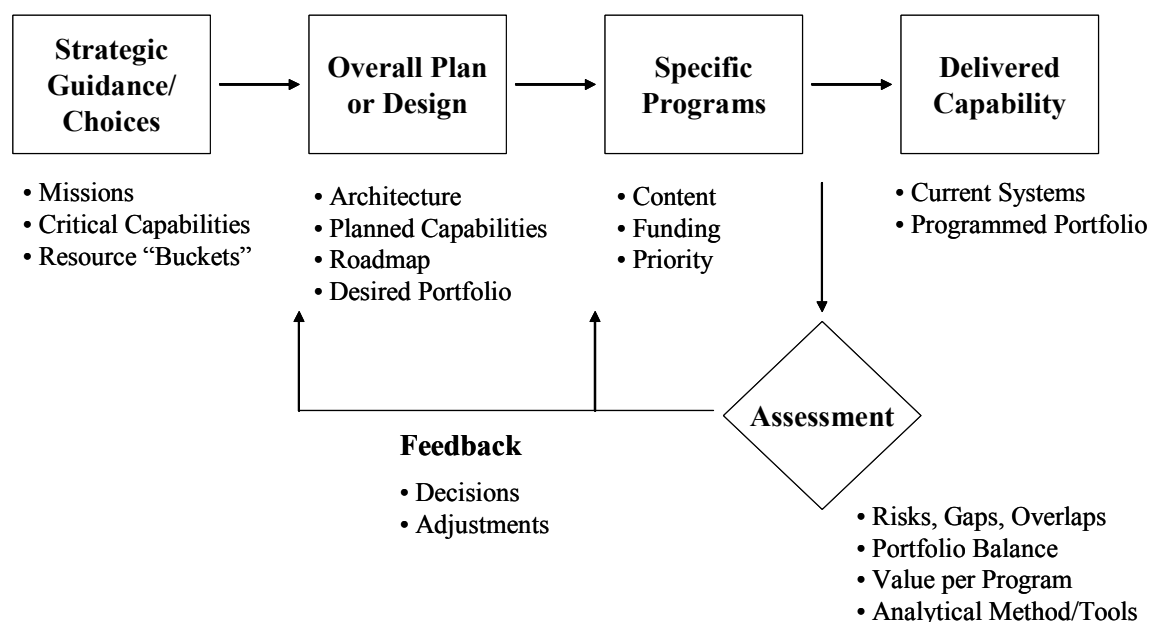
The AF corporate process and DoD decision support systems have always had to make difficult resource decisions based on perceived strategic priorities. The post Cold War budget

declines and continued high operations tempo added pressure to this process, as funds available for modernization were squeezed by competing requirements to pay for readiness, infrastructure, personnel, and sustainment of aging platforms. The introduction of new capabilities-based planning concepts has not changed this dilemma, but it has sought to establish more consistent and compelling logic for prioritizing scarce resources.

The compelling logic needs to be enforced by a “control system” that sets strategic goals, performs assessments to measure progress, and employs feedback mechanisms to make adjustments. Figure 4 shows a notional representation of this idea. Goal setting and assessments/feedback tend to be at the “front end” and “tail end,” respectively, of any comprehensive framework for capabilities-based planning. Strategic goals include solving challenges in important missions, addressing new or critical threats, and achieving better joint integration. Other top-down strategic guidance comes from the National Security Strategy, the annual Defense Planning Guidance, Joint Vision 2020, and Service visions and strategic plans. At the assessment end of the framework, offices such as OSD Program Analysis and Evaluation assess the alignment of programs with strategic priorities (at least in principle), and do not hesitate to make adjustments where they see fit. The main difficulty is in backing up the “feedback controls” with credible analytical schemes and assessments to determine what programs best contribute to meeting the goals, and how well they do it.

What is needed for a credible assessment in a particular mission area? As Figure 4 suggests, strategic guidance and critical desired capabilities should drive the “success criteria” for the review. A disciplined analytical methodology should be used to evaluate or score programs against those criteria. Accurate, consistent technical and programmatic data are required on the individual programs being evaluated. Finally, it is highly desirable to have an

“overall plan” for the mission area as a reference point to assess against—which may take the form of an architecture, roadmap, or desired portfolio of programs, for instance. Ideally, this



**Figure 4. “Control System” to Prioritize Resources**

“plan” would be aligned with the strategic guidance, and show “rigorous” links between strategic priorities and specific programs.<sup>37</sup> With such a plan in place, it becomes possible to assess a proposed portfolio (i.e., a POM submission) directly against the plan, and to recommend adjustments based on observed gaps, overlaps, etc. Without such a plan, assessments are likely to involve more ad hoc and subjective judgments of how well programs, or collections of programs, meet the intent of strategic guidance. In the latter case, a good assessment may still be possible, but the lack of “connective tissue” increases the risk of missing important interdependencies.

The fledgling CRRA process is the emerging AF control mechanism to assess the linkage between desired capabilities and program choices. Its leaders have recognized the importance of

building an integrative “plan” or design construct within the CRRA logic flow; for instance, to document the elements and attributes of a particular capability, and the programs that support the capability. In fact, the Space and C4ISR CRRA (completed in late 2002) presented some informal architecture-type views and products—a “capabilities view” pictorial diagram and a “capability flow” specifying functions and their inputs and outputs. Thus, the CRRA teams did some ad hoc architecting and systems engineering to build a structure on which to do their assessments—even if it was not explicitly recognized as such.<sup>38</sup> Eventually, these “design” activities should be decoupled from the CRRA assessment and feedback “event.” The “plan” or architecture would become the enduring “meat on the bones” associated with the Task Force CONOPS—subject to ongoing adjustments, but giving the CRRA event something relatively stable and credible to assess against.

Similar assessment structures are emerging elsewhere in the national security community. The undersecretary of the Air Force, in his role as Executive Agent for Space, conducts an annual National Security Space Program Assessment and is developing a National Security Space Master Plan to provide a reference point for that assessment.<sup>39</sup> The Navy “mission capability package” approach (see Appendix A) and Network Centric Warfare theory propose assessment frameworks based on portfolios of programs rather than individual platform/program decisions. New DoD policy also calls for the Undersecretary of Defense for Acquisition, Technology, and Logistics to lead architecture-level capability assessments “as the basis of aligning resources as an input to the Defense Planning Guidance, POM development, and Program and Budget Reviews.”<sup>40</sup> It is not clear yet just how these joint reviews would be implemented, or what scheme would be proposed to harmonize joint and Service-developed architectures and roadmaps.

Whatever the quality of the “overall plan” in Figure 4, an assessment framework must ultimately rank or prioritize within a list of candidate programs, projects or adjustments. Various analytical methods and tools can be considered for this purpose. For example, organizations and studies have used “value models” to suggest priorities for technology investments, including a recent National Reconnaissance Office effort.<sup>41</sup> The Navy used a scoring approach to rank science and technology projects within an executive portfolio review process,<sup>42</sup> and before that, the AF had used value models in performing “Air Force 2025” and similar long-range planning studies in the mid- to late-1990’s.<sup>43</sup> The AF also uses a subjective scoring model in the corporate process that builds POM recommendations for a group of classified programs. Scoring models are cited as effective portfolio management tools for companies that need to prioritize among new product development efforts.<sup>44</sup> All of these models involve structured analytical frameworks that measure the merits of concepts or technologies by scoring them against a set of evaluation criteria. The criteria are typically organized in a logical hierarchy, weighted based on user priorities and other factors, and can be “rolled up” to produce overall value scores. Scoring of specific projects against each criterion may involve a mix of objective analysis and subjective judgment.

Value models have their pros and cons. One concern is the usefulness of the “scores” produced by the models. Although methods exist to gauge the robustness of the scoring results to variable factors,<sup>45</sup> the resulting “numbers” may still be viewed with caution. They represent just one metric or tool for decision makers to use. Practitioners often say that the real value in value modeling is in the insights gained from going through the mechanics of the process.<sup>46</sup> Another concern deals with the scope of the required effort. When confined to a limited domain such as the programs supporting a particular mission area, or to technology programs (as done by

the NRO and Navy), the model creation and assessment process can be manageable; although still a time-intensive endeavor that may require senior officers to sit through exhaustive review sessions. For much larger domains, the scope of a value model could get out of hand.<sup>47</sup> Thus, value model type assessments need to be implemented at an appropriate level; for instance, at the level of a “mission capability package,” or CRRA key capability. If such approaches are taken in the CRRA, some degree of process standardization will need to be imposed across Task Forces, but the models will need to be tailored to each domain area. A “model of everything” for the entire AF or DoD program space is beyond the scope of what is reasonable.

If value models and similar ranking schemes are most applicable for assessments within limited domains, a broader question remains: how to assess, prioritize, balance and integrate among all mission areas or portfolio sectors—as well as with infrastructure, combat support, and other corporate demands? This is a fundamental question for any “control framework,” including today’s Air Force corporate model. Someone must take an “independent” look across the totality of resource demands. This is a role that the “XP” programming community plays in the current AF corporate process, and should continue to play. Ultimately though, the chief of staff and secretary of the Air Force are required to grasp the issues and make decisions to accomplish the final balancing and integration.<sup>48</sup> This is a huge vertical and horizontal integration challenge, especially considering the lack of an analytical basis or methodology for decision support.<sup>49</sup> A recent study showed almost unanimous consensus that decision support tools are not used in the current AF corporate structure and decision-making processes.<sup>50</sup>

To a large extent, priority-setting and horizontal balancing occurs “a priori” when HQ USAF allocates budget “bogeys” to the MAJCOMs, thereby bounding their portions of the POM. Decisions “on the margins” in the final review stages of the PPBS do not substantially



change the overall balance in the Air Force portfolio. This practice mirrors what industry researchers have called the “strategic buckets” method for portfolio management: senior management provides top-down guidance that bins spending by project types, technologies, or product lines. The highest-performing companies tend to use the strategic bucket and scoring methods in their implementation of portfolio management, versus the traditional financial methods favored by the majority of companies.<sup>51</sup> Thus, a priori resource allocation can be considered a business “best practice”—provided of course that the allocation lines up with strategic priorities. The Air Force may be pressured to adjust the content of its strategic buckets based on QDR transformation goals or other strategic guidance. For example, the pressure to transform suggests that DoD increase investment in science and technology accounts, which currently get less than three percent of the defense budget.

A final aspect of the “control problem” from Figure 4 concerns the timing and purpose of periodic assessments or portfolio reviews. Within DoD, these are strongly driven by the annual PPBS rhythm and requirements. The Air Force expects its CRRA process to eventually align with PPBS timing, after the initial start-up. However, portfolio management has the potential to become a more dynamic enterprise, in both timing and scope. Cooper et al. describe an industry “best practice” model where portfolio reviews are more frequent (two to four times per year) and comprehensive (covering all development programs, not just the “initiatives and disconnects”) than in current DoD practice.<sup>52</sup> Moreover, portfolio reviews are tightly integrated with program milestone decisions in the “best practice” model (see Appendix A for details).

Do these more dynamic business standards constitute another pressure on DoD? Is it practical to consider applying the best practices to DoD or AF processes? Perhaps not, since even the set of programs within a Service’s purview is much larger and more interdependent than

a business portfolio, with unique political and process constraints. To comprehensively apply the best practices would be very difficult. On the other hand, the payoff from a dynamic, integrated portfolio management approach could be significant over the long run—and even more appropriate than in the business environment to maximize overall corporate efficiency.

The pressures in DoD to “prioritize, assess and control” seek to maximize alignment, value, and balance in the overall portfolio of programs, and to implement corrections where appropriate. A fine line exists between controls that could empower change, or stifle it. The pressures drive a complex set of tensions both internal to the AF and at its boundaries with the rest of DoD. One aspect of this is the competition between mission interests (what do we need?) and programming realities (what can we afford?). This friction is healthy—both programmers and Task Force proponents agree.<sup>53</sup> However, a more unpleasant friction occurs when Air Force and OSD “control systems” do not align fully in terms of their goals, assessment methods and criteria. Tensions may also appear between value-driven and interoperability-driven judgments. Value models tend to stress utility and cost-effectiveness, but do not necessarily look across stovepipes and identify synergies unless explicit criteria are put in place to make it a priority. Thus, “assessment and control” pressures tend to reinforce “architecting” pressures, since good architectures or “plans” provide a more solid and complete basis on which to conduct assessments. There are many candidate paths to improvement in this area, including application of ideas from industry best practices. Meanwhile, choices will be made using imperfect data.

### **Pressure to Reform Acquisition and Requirements Processes via Evolutionary Strategies**

The deputy secretary of defense’s memorandum of 30 October 2002 states that “I have determined that the current (DoD acquisition policies) require revision to create an acquisition policy environment that fosters efficiency, flexibility, creativity and innovation.”<sup>54</sup> At the same

time, the Joint Staff cancelled elements of joint requirements policy, because “the current process frequently produces stove-piped solutions that are not necessarily based on the future capabilities required by the joint warfighter.” The combined changes to the acquisition management and requirements generation systems seek to implement a more integrated and collaborative set of processes.<sup>55</sup> In fact, the new policies seek to correct a host of problems with acquisition management (some caused by previous “reform” efforts) that have contributed to many “broken” programs, multi-billion dollar cost overruns, and chronic dissatisfaction with the processes.

Acquisition management has traditionally been among the most vertically configured of all DoD processes. Milestone decisions are made on a program-by-program basis, and periodic portfolio reviews (like the former Air Force QAPR) have done little to facilitate comparisons or integration across programs. Stove-piping is partly driven by DoD and Congressional oversight requirements, and a PPBS program element structure that earmarks funds for specific programs vice bins of capabilities. Program managers are trained to minimize disturbances to their program baseline, and thus are naturally disinclined to comply with interoperability policy, or to surface cross-system issues to decision-makers.<sup>56</sup> Until program managers and senior acquisition leaders are given incentives to make architectural “fit” a priority, the overall strategy of capabilities-based modernization planning will struggle. In effect, acquisition stove-piping allows many different “pseudo-architects” to arrange the building blocks of military capability in ad hoc fashion.

Responsibility for inflexible and stove-piped acquisition programs has been shared by the supporting requirements generation system. Requirements documents were staffed in an inflexible and exhausting process that stifled innovation, tradeoffs, and the opportunity to take a

portfolio perspective.<sup>57</sup> Users tended to pile requirements on every program, not confident that capabilities traded off in one program would be met elsewhere. They thus stood firm on Key Performance Parameters and threshold requirements—even if costs, risk, and technical challenges were only poorly understood, and funding was limited. Attempts to define reasonable incremental steps were typically overwhelmed by the interest in getting to the end-state performance defined in an Operational Requirements Document.<sup>58</sup>

Previous generations of acquisition reform have sought to improve cost-efficiencies in individual programs by appealing to commercial best practices, performance-based contracting, “cost as an independent variable,” and other streamlining measures. Technical and integration risks were transferred from the government to industry, as government program offices were downsized. These initiatives were only partly successful. Meanwhile, the combination of pressures to “contain cost” and “meet the thresholds” led a strained defense industry to make aggressive promises that couldn’t be kept. As programs stalled or failed, the tendency was for acquisition managers to become more and more risk averse.

The clear way out of this acquisition “gridlock” was to make changes to allow for (1) more time-phased programs to deliver capability in realistic increments; (2) more trade space in requirements (both within and across programs); and (3) more opportunities to take risks. Thus, the new acquisition policy emphasizes “evolutionary acquisition” as the preferred strategy, to be specifically implemented in either “spiral” or “incremental” development approaches. Requirements definition will correspondingly take on an evolutionary, capabilities-based flavor. For instance, in the spiral development approach, “a desired capability is identified, but the end-state requirements are not known at program initiation.”<sup>59</sup> The new “5000 series” model notionally depicts “integrated decision meetings” to coordinate requirements documents and

acquisition milestones. To ensure requirements flexibility, new policy allows mission area integrated architectures to serve as sources of capstone-level requirements for system-of-systems and family-of-systems mission areas, replacing the previous concept of a Capstone Requirements Document that included “validated” Key Performance Parameters and other top-down requirements.<sup>60</sup>

The new DoD policies will likely help in solving many of the chronic problems in the acquisition management and requirements generation systems; but problems related to “jointness” remain formidable challenges. Though the new policies stress the importance of joint, integrated capabilities, they do not begin to address the details of implementation in this arena. Using architectures to document requirements is an embryonic discipline within DoD, and the degree of leadership commitment to the initiative remains unknown.<sup>61</sup> Joint acquisition mechanisms are almost non-existent (outside of special operations). The Joint Staff director recently noted, “DoD is not effectively structured to effect the ‘organizing, training and equipping’ of joint forces. There is no joint process responsible and accountable for developing and acquiring joint command-and-control systems and integrating capabilities.”<sup>62</sup> DoD’s senior acquisition executive expressed similar thoughts, saying that

When it comes to buying something that’s joint, there’s no one responsible for that organize-training-equipping function; therefore, I think it’s not done very well... If there was a Title 10 responsibility somewhere, somebody would have that responsibility to get it in place before we actually need it. There’s simply no one around that does that. It’s going to be very tough to decide how we organize this... but creating a new DoD-wide program management agency in OSD is probably not the right answer.<sup>63</sup>

While Service chiefs have expressed strong opinions that it is not in DoD’s best interest to realign Service and joint responsibilities for training, organizing, and equipping forces, senior DoD leadership may decide otherwise. Some argue to give more acquisition authority to joint

combatant commanders. The pressure to improve joint acquisition is clear, but the best way to do it is far from obvious.

The Air Force and DoD are both pushing for better assessments of acquisition programs' contributions to support critical CONOPS and capabilities. This is the juncture between the acquisition reform pressure and the pressure for better portfolio management and resource prioritization. Currently, major PPBS and acquisition milestone decisions are not made "in the same room." This departs from the most successful business approaches, which integrate acquisition "gates" into larger program reviews, portfolio prioritizations, and resource allocation processes.<sup>64</sup> Were the Air Force to follow the business model, it would involve a synthesis of the CRRA, corporate structure "rack and stack" meetings, and acquisition "go/kill" milestone reviews. For now, the AF CRRA process has replaced the QAPR at the intersection of acquisition and portfolio management; though the coupling between the two processes otherwise remains extremely loose.

Ideas for tighter process integration are evidently being pursued at the DoD level. In one proposal, joint system-of-systems architectures are to be defined within Joint Mission Areas and evolve to "tightly federated" status within a few years. As these joint architectures take shape, acquisition reviews (i.e., Defense Acquisition Boards) are expected to identify the mission area impacts of program decisions; and a series of OSD/Joint Staff "mission area reviews" are suggested to ensure balance in the portfolio supporting each Joint Mission Area.<sup>65</sup> The recent "5000 series" policy changes also task the USD(AT&L)—the Milestone Decision Authority for most major programs—to "lead development of integrated plans or roadmaps to guide systems development... and to conduct capability assessments as the basis of aligning resources"; implying that DoD has a vision to integrate acquisition and portfolio management

responsibilities.<sup>66</sup> Obviously the proposed Air Force CRRA and DoD “mission area review” processes are completely analogous; the challenge will be to ensure that sufficient synchronization is “designed in” up front as these processes develop. Otherwise the roles, responsibilities, and outcomes of the processes may clash.<sup>67</sup>

The pressures to reform acquisition management seek to improve efficiency, flexibility, innovation, jointness, and integration with other DoD control processes. Can all of these be achieved, in conjunction with the pressures discussed earlier? Possibly yes, though it will take time. Issues that can be addressed within the individual Services and agencies will be easiest to tackle, but even these could be challenging. Struggling programs do not get fixed overnight, and some, like space programs, are less amenable to being structured in careful, incremental steps.<sup>68</sup> Absent a major legislative change in Title 10 authorities, the most likely “order of difficulty” (from easiest to hardest) in addressing the pressures appears to be (1) fixing broken programs within Services, and defining new evolutionary strategies where needed; (2) beginning to use “architecture logic” and portfolio management discipline to make it easier to trim less-needed programs, within Service-centric missions; (3) achieving tight coupling between intra-Service decision-making processes for PPBS, acquisition, and requirements generation; and (4) implementing a fully joint, integrated approach to acquisition management.

Even if a fully joint vision proves unachievable, the goal of integrated Service processes is compelling to aim for. As capabilities-based architectures mature and requirements flexibility increases for individual program increments, the program manager’s job gets easier—and interoperability requirements become more palatable. Conversely, evolutionary system deliveries fit into a “building block” approach, giving mission architects and programmers better ammunition to build and defend their portfolios. The “independent” processes become more

symbiotic. This may be the only way to succeed in building complex systems of systems. The new CRRA process could eventually help fill this role.

### **Pressure to Implement DoD Reorganizations for Space, Homeland Defense, etc.**

The Air Force has struggled to define the role of space in its overall strategy and doctrine.<sup>69</sup> Concerns about DoD and Air Force stewardship of US space power led Congress to establish a special Space Commission to evaluate space management issues, including the possibility of a separate space force.<sup>70</sup> The DoD is now implementing most of the January 2001 Commission report recommendations—which ironically have increased the Air Force’s overall responsibilities for organizing and equipping military space forces.<sup>71</sup> The undersecretary of the Air Force (USecAF) is now designated as Executive Agent, Milestone Decision Authority, and funding advocate for space programs, across the Services and for National Reconnaissance Office (NRO) programs. The new USecAF office is responsible for space acquisition oversight, program execution, architecture development, and integration functions (for both Air Force and NRO programs). His staff writes the National Security Space Master Plan and conducts the National Security Space Program Assessment.

This reorganization sharpens focus on strategic planning, architectures, integration, resource prioritization, and acquisition, helping to connect top-level strategy to programs and funding priorities *for space*. However, it creates tensions with the mainstream Air Force corporate processes. The USecAF is expected to serve as both an Air Force corporate leader, and an “independent” assessor of the POM for joint space interests. This gives him unique influence, but his positions may clash with AF or OSD positions, or both.<sup>72</sup> Otherwise, the new space structure aligns reasonably well with the AF panels and MAJCOMs, but much less clearly with the Task Force CONOPS and other transformation initiatives. Space provides crosscutting



capabilities across multiple task forces. The need for a separate space CONOPS has been argued, and in fact, AF Space Command expended considerable effort on CONOPS development in response to a February 2001 CSAF directive.<sup>73</sup>

As it stands today, space staffs will have a difficult time connecting the space master plan and program assessment to the Task Force CONOPS and CRRA, as well as to other joint mission areas and integrated architectures. The “cross-reference matrix” appears almost unmanageable. The space community has had limited success in tackling this challenge to date, and is buffeted by poor program performance and major differences of opinion on program priorities among OSD, the Air Force, and others.

Organizations responsible for leading other high-priority DoD missions like homeland defense and missile defense may also overlap with Air Force organizations, missions, programs, and priorities. If these organizations expect to leverage AF systems and resources, similar tensions with the AF corporate processes can be expected. What effects might this have? First, some programs will likely be “fenced” and not subject to the same prioritization criteria as other programs within Service portfolios. Second, a system with multiple missions could be required to support multiple architectures or systems-of-systems, managed by different architects with different priorities.<sup>74</sup> In reviewing systems for their contributions to important Task Force capabilities, the Air Force may have little ability to influence programs when their requirements and funding are dominated by non-Air Force sponsors. The AF will have to “make do” with the systems’ inherent capabilities to provide support to Task Forces.

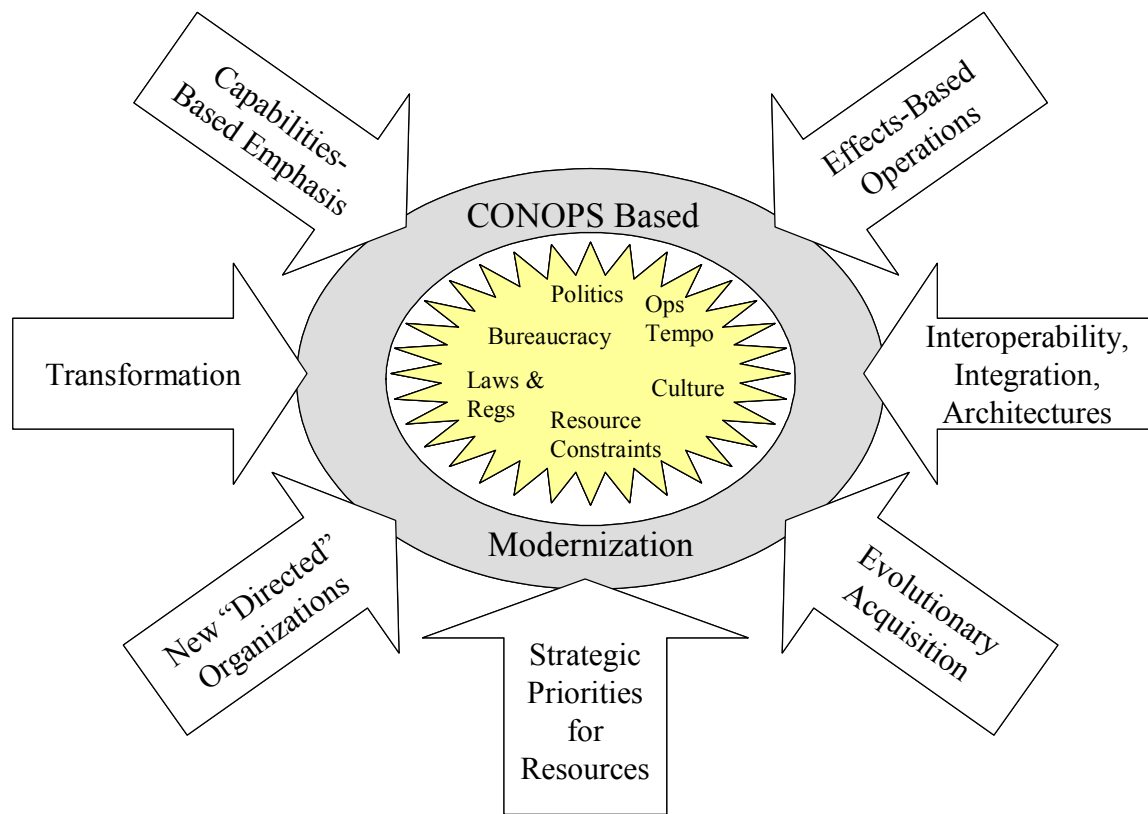
## **Summary**

This set of competing pressures suggests the need to improve DoD performance and resolve issues on many fronts. Pressures for strategic alignment (with priority missions and

threat “challenges”), flexibility (incremental building blocks, supporting multiple missions), innovation (anticipate change, maintain technical and operational edge), joint interoperability, integration (of capabilities and processes), efficiency (best use of limited funds), completeness (of “plans” and architectures), and organization (to best focus on priorities) must all be appreciated. The Air Force has placed Task Force Champions at the focal point of these pressures. An “ideal” champion entity would have the tools and authorities to advocate in corporate resource deliberations, direct (or at least coordinate) architecture development and integration activities, have a voice in acquisition portfolio reviews (CRRA) as well as requirements approval and milestone decisions, and a link to the operational organization(s) and their expeditionary force rhythms. The current Task Force Champions only perform the resource advocacy and CRRA functions, with a degree of influence yet to be determined even in those areas. Architect, integrator, and acquisition oversight roles would be growth areas. To achieve the “ideal” may require giving the Task Force Champion the authorities currently held by multiple senior officers; and possibly a major reorganization of HQ USAF and MAJCOM staffs to realign acquisition, architecting, integration, planning, programming, and operational requirements—analogous to what was done in realigning the USecAF staff to implement the Space Commission recommendations.<sup>75</sup> Even if such gross reorganizations are unrealistic, it seems prudent to consider aligning additional “mission architect” or “functional architect” capacities with each Task Force CONOPS. Different approaches and emphases for doing this are part of the alternatives defined in Chapter 6.

Again, all of these pressures are brought to bear in a turbulent, uncertain security environment amid various political pressures, bureaucratic inertia, legacy cultures in industry and DoD, existing regulations and statutes, resource constraints, and continued requirements for

overseas operations and US military presence. These forces tend to counter the pressures that seek to organize, streamline, and align the resource prioritization process. The Air Force modernization framework must be able to harness and synchronize the beneficial pressures in order to contain and manage the resistive forces (Figure 5). To some extent, the complex checks and balances of the DoD decision-making processes will preserve a structure that is inherently inefficient, yet allows debate and consensus building to occur—much like in Congressional and interagency decision-making. This does not preclude improvements, it should just temper expectations as to the degree of change that can realistically occur.



**Figure 5. Competing Pressures**

## Notes

<sup>1</sup> Edward Mann, Gary Endersby, and Tom Searle, “Dominant Effects: Effects-Based Joint Operations,” *Aerospace Power Journal* (Fall 2001), n.p., on-line, Internet, 23 October 2002, available from <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj01/fal01/vorfal01.html>.

<sup>2</sup> Lt Col Ted T. Uchida, “Analysis of Effects-Based Operations – The Road Ahead to Doing Business Differently” (unpublished NATO conference paper, 2002), A8-1-A8-2, on-line, Internet, 24 October 2002, available from <http://www.nc3a.nato.int/symposia/sas039/proceedings/P4.doc>. Perspectives on EBO range from the simple—considering the likely effects on adversary behavior before taking actions; to the complex—EBO as a systematic process using all instruments of national power to produce synergistic and cumulative effects to influence behavior.

<sup>3</sup> Air Combat Command, Effects Based Operations, Glossary.

<sup>4</sup> Air Combat Command, Effects Based Operations, 4-6.

<sup>5</sup> John M. Donnelly, “Pentagon Weighs How To Budget For Interoperability,” *Space & Missile Defense Report* (14 November 2002): 2.

<sup>6</sup> CJCSI 3170.01B, E-5-E-7; CJCS Instruction 6212.01B, *Interoperability and Supportability of National Security Systems, and Information Technology Systems*, 8 May 2000, B-1-B-20. Interoperability requirements must be certified by the Joint Staff J-6, with assistance from Joint Forces Command and the Defense Information Systems Agency—which is also responsible for testing and certifying systems for interoperability when they are fielded. See CJCSI 3170.01B, B-4; DoDI 4360.8, 17, 19, 30.

<sup>7</sup> Joint Forces Command, “Information Exchange Requirements, Process,” on-line, Internet, 15 December 2002, available from <http://www.teao.saic.com/jfcom/ier/process.htm>.

<sup>8</sup> Alexander H. Levis, “Architectures, Architects and DoD” (briefing for C4ISR Architecture Framework Implementation Course, Lecture 1, Langley AFB, VA, May 2002), 5, on-line, Internet, 14 December 2002, available from <http://www.cc.hq.af.mil/ST/Lecture1.pdf>.

<sup>9</sup> Paul G. Carlock and Robert E. Fenton, “System of Systems (SoS) Enterprise Systems Engineering for Information-Intensive Organizations,” *Systems Engineering* 4, no. 4 (2001): 243.

<sup>10</sup> Undersecretary of Defense (Acquisition and Technology), Acting Assistant Secretary of Defense (C3I), and Director for C4 Systems, Joint Staff, memorandum for Secretaries of the Military Departments et al., subject: Strategic Direction for a DoD Architecture Framework, 23 February 1998.

<sup>11</sup> DoD Architecture Framework Working Group, *DoD Architecture Framework Version 1.0, Volumes I-III* (Draft), 1 October 2001, on-line, Internet, 14 December 2002, available from <http://www.cc.hq.af.mil/ST/DODAFv1.pdf> to <http://www.cc.hq.af.mil/ST/DODAFv3.pdf>.

<sup>12</sup> Other federal models include the Federal Enterprise Architecture Framework (FEAF) and Treasury Enterprise Architecture Framework (TEAF). For a summary and comparison of federal models, see P. Kathie Sowell, “The C4ISR Architecture Framework: History, Status, and Plans for Evolution” (paper presented at the 5<sup>th</sup> International Command and Control Research and Technology Symposium, Canberra, Australia, October 2000), n.p., on-line, Internet, 21 October 2002, available from <http://www.dodccrp.org/2000ICCRTS/cd/papers/Track7/067.pdf>, and Rob C. Thomas II, “C4ISR Architecture Framework Implementation” (briefing for C4ISR Architecture Framework Implementation Course, Lecture 2, Langley AFB, VA, May 2002), 4-6, 15-28, on-line, Internet, 14 December 2002, available from <http://www.cc.hq.af.mil/ST/Lecture2.pdf>. These references also summarize how the federal frameworks are based on theories from information systems architectures, including the so-called Zachman framework and Spewak Enterprise Architecture Planning. The commercially oriented Open Group Architecture Framework (TOGAF) is available from <http://www.opengroup.org/TOGAF>.

<sup>13</sup> Department of Defense, *Report to Congress: Kosovo/Operation Allied Force After-Action Report* (Washington DC: Department of Defense, 31 January 2000), 131.

<sup>14</sup> Secretary of Defense, *Annual Report to the President and the Congress*, Appendix K (Washington DC: Department of Defense, 1998), n.p., on-line, Internet, 10 December 2002, available from <http://www.defenselink.mil/execsec/adr98/index.html>.

<sup>15</sup> Gen Henry H. Shelton, Chairman of the Joint Chiefs of Staff, memorandum, CM-1014-00, subject: Joint Mission Areas to Organize the Joint Operational Architecture, 6 September 2000, on-line, Internet, 15 December 2002, available from [http://deskbook.dau.mil/htmlfiles/DBY\\_multi.asp](http://deskbook.dau.mil/htmlfiles/DBY_multi.asp).

<sup>16</sup> DoDI 4630.8, 25-28.

<sup>17</sup> Formerly, this process would identify top-level IERs for a proposed family- or system-of-systems, which subsequently would be used to define interoperability Key Performance Parameters within a Capstone Requirements

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Documents (CRD). However, with the recent changes to governing requirements and acquisition instructions, a CRD is no longer required. It will be sufficient to capture the required information in mission area integrated architectures as they are developed and refined. See Maj Gen Hawkins, Changes to the Requirements Generation System.

<sup>18</sup> Lt Col Peter Bonanno, HQ USAF/XPXT, interviewed by author, 17 December 2002.

<sup>19</sup> Gen Richard B. Myers, Vice Chairman of the Joint Chiefs of Staff, remarks to the AFCEA Technet International 2001 Luncheon, Washington DC, June 6, 2001, on-line, Internet, 10 December 2002, available from [http://www.dtic.mil/jcs/vice\\_chairman/vcjc-AFCEA.htm](http://www.dtic.mil/jcs/vice_chairman/vcjc-AFCEA.htm).

<sup>20</sup> Gen Jumper interview.

<sup>21</sup> The vice chairman already has a key seat in the three decision processes, as well as in DoD's Interoperability Senior Review Panel that also includes the DoD chief information officer, the undersecretary of defense for Acquisition, Technology and Logistics, and the commander, Joint Forces Command. See Jack Zavlin, "Achieving Interoperability for Information: Using Architectures and Teamed Leadership" (briefing presented to the GEIA IT Integration Committee and IT Security & Communications Council, Arlington, VA, 23 August 2001), 5, on-line, Internet, 14 December 2002, available from [http://www.geia.org/sstc/iti/OSD\\_Interoperability.pdf](http://www.geia.org/sstc/iti/OSD_Interoperability.pdf).

<sup>22</sup> Mara, 4-5.

<sup>23</sup> CAPT John Yurchak, "Battle Force Capabilities / Mission Capability Packages" (briefing presented at Navy Interoperability Workshop, Crystal City, VA, 30 May 2001), 9, on-line, Internet, 14 December 2002, available from <http://www.dtic.mil/ndia/2001interop/yurchak.pdf>; Eric N. Skoog, "Air Force Architectures (an AF-CIO Perspective)" (briefing for C4ISR Architecture Framework Implementation Course, Lecture 3, Langley AFB, VA, May 2002), 16, on-line, Internet, 14 December 2002, available from <http://www.cc.hq.af.mil/ST/Lecture3.pdf>; US Air Force, "Air Force Enterprise Architectures" (briefing, Washington DC: AF CIO/A and AF/XIW, 17 December 2002), 4, 13.

<sup>24</sup> DoD, Transformation Planning Guidance briefing. It is not clear how the Joint Operating Concepts and a "Joint Capstone Concept" referenced in this briefing relate to the Joint Operational Architecture and Joint Mission Areas described in existing DoD and CJCS policy.

<sup>25</sup> David S. Alberts, John J. Gartska, and Frederick P. Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority*, 2<sup>nd</sup> Ed., Revised (Washington DC: DoD C4ISR Cooperative Research Program, August 1999), 227, on-line, Internet, 13 December 2002, available from <http://www.dodccrp.org/>.

<sup>26</sup> The issue was the subject of the author's policy paper at Defense Systems Management College in Fall 1998.

<sup>27</sup> Dr. Alexander Levis, chief scientist, US Air Force, interviewed by author, 17 December 2002.

<sup>28</sup> Col John Hyten, interviewed by author, 17 December 2002. Col Hyten formerly led the Joint Staff's operational architecture effort.

<sup>29</sup> Dr. V. Garber, Director for Interoperability, OUSD(AT&L), "Department of Defense View" (briefing presented at Navy Interoperability Workshop, Crystal City, VA, 30 May 2001), 4, on-line, Internet, 14 December 2002, available from <http://www.dtic.mil/ndia/2001interop/garber.pdf>.

<sup>30</sup> Mission areas that are using architectures to guide the definition, funding, and integration of systems and technologies include national missile defense, joint theater air and missile defense, certain space architectures such as satellite communications, and a national signals intelligence (SIGINT) architecture. Capabilities in these mission areas tend to be provided by a complex system-of-systems (or network, or family of systems), and there is generally a "mission architect" to define the top-level configuration and/or a "chief engineer" with a staff to provide the necessary systems analysis, engineering, and integration. The Missile Defense Agency, Joint Theater Air and Missile Defense Office, and the National Security Space Architect are examples of organizations performing these functions, or at least attempting to do so.

<sup>31</sup> "Mandatory" products include overview and summary information (AV-1), an integrated dictionary (AV-2), high-level operational concept description (OV-1), operational node connectivity description (OV-2), operational

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information exchange matrix (OV-3), activity model (OV-5), system interface description (SV-1), and technical architecture profile (TV-1). About 20 other products are considered “supporting” and may be needed depending on the purpose of the architecture. For details see *DoD Architecture Framework Version 1.0, Volume II: Product Descriptions* (Draft), 1 October 2001, vii-43, on-line, Internet, 14 December 2002, available from <http://www.cc.hq.af.mil/ST/DODAFv2.pdf>.

<sup>32</sup> Levis, “Architectures,” 7.

<sup>33</sup> Stephen Cook, Joe Kasser, and Martin Burke, “Assessing the C4ISR Architecture Framework for the Military Enterprise” (paper presented at the 5<sup>th</sup> International Command and Control Research and Technology Symposium, Canberra, Australia, October 2000), n.p., on-line, Internet, 10 December 2002, available from <http://www.dodccrp.org/2000ICCRTS/cd/papers/Track7/016.pdf>.

<sup>34</sup> Doug Hamilton, “Linking strategic information systems concepts to practice: systems integration at the portfolio level,” *Journal of Information Technology* 14 (1999): 69, 78-81. Hamilton studied a large telecommunications enterprise that made multiple attempts at architecture-driven development over several decades. He acknowledges value in developing and managing architectures as “knowledge structures,” but recommends decoupling this from the development and implementation of systems under the architecture’s umbrella.

<sup>35</sup> This specifically concerns the push for data fusion and machine-to-machine integration of multiple sources to improve the timeliness, accuracy, relevance, and quality of information feeding key information-driven functions: intelligence, surveillance, targeting, warning, fire control, battle damage assessment and others.

<sup>36</sup> Andrew P. Sage and Charles L. Lynch, “Systems Integration and Architecting: An Overview of Principles, Practices, and Perspectives,” *Systems Engineering* 1, no. 3 (1998): 176.

<sup>37</sup> Whether it is called a plan, roadmap, architecture, integrated portfolio, or other term, this entity of “connective tissue” between strategy and programs is identified as a pivotal (and often missing) link in proposals for improved modernization frameworks; for instance, in the CJCS advocacy for a Joint Operational Architecture.

<sup>38</sup> Headquarters USAF, “Space and C4ISR CRRA,” n.p. Observations also based on the author’s interview with Col Robert Gordon, Space and C4ISR Task Force Champion.

<sup>39</sup> Separate offices guide these two efforts—a strategy intended to foster objectivity, if not efficiency, in the planning and assessment processes.

<sup>40</sup> DepSecDef, Defense Acquisition, Attachment 2, 3.

<sup>41</sup> Gregory S. Parnell et al., “Multiple Perspective R&D Portfolio Analysis for the National Reconnaissance Office's Technology Enterprise,” *Military Operations Research* 6, no. 3 (2001): 19-34.

<sup>42</sup> Ronald N. Kostoff, Robert Miller, and Rene Tshiteya, “Advanced technology development program review – a US Department of the Navy case study,” *R&D Management* 31, no. 3 (2001): 287-298.

<sup>43</sup> Dr. Gregory S. Parnell et al., “Foundations 2025: A Value Model for Evaluating Future Air and Space Forces,” *Management Science* 44, no. 10 (October 1998): 1336-1350.

<sup>44</sup> Robert G. Cooper, Scott J. Edgett, and Elko J. Kleinschmidt, “New Problems, New Solutions: Making Portfolio Management More Effective,” *Research · Technology Management* (March-April 2000): 22, 27; K. L. Poh, B. W. Ang, and F. Bai, “A comparative analysis of R&D project evaluation methods,” *R&D Management* 31, no. 1 (2001): 63-72. Other viable tools and techniques used in portfolio management include traditional financial methods, visual representations like “bubble diagrams” that display balance in a portfolio, and the so-called Analytic Hierarchy Process—a type of value model built from pairwise comparisons of alternatives. See Poh et al., 64-65.

<sup>45</sup> For instance, sensitivity analyses, “alternative views,” or “alternative futures” methods that quantify impacts of variations in scenarios, substantially different criteria weightings, and modeling or scoring uncertainties vs. the criteria. See the discussion in Davis, 47, or in Parnell et al., “Foundations 2025,” 1345-1347.

<sup>46</sup> By identifying appropriate criteria, defining scoring curves for each criterion, and judging how well different concepts perform on those curves, the assessors gain great insights into (1) what is important, and (2) what are the strengths and weaknesses of concepts—the two fundamental questions that a control process seeks to answer.

<sup>47</sup> However, US Special Operations Command’s *entire* budgetary process is worked via value models. The value model matrix in 2000 had over 34,000 assessment squares. The process is time-consuming, but manageable. Thus, it may set an approximate “upper bound” for a workable scope of such an effort. The author is grateful to Lt Col John Geis for this observation.

<sup>48</sup> Lewis et al., 76.

<sup>49</sup> Such as the methodologies described in Davis, 43-49, and Richard J. Hillestad and Paul K. Davis, *Resource Allocation for the New Defense Strategy: The DynaRank Decision-Support System*, RAND Report MR-996-OSD

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(Santa Monica, CA: RAND, 1998), 1-9, on-line, Internet, 18 November 2002, available from <http://www.rand.org/publications/MR/MR996/>.

<sup>50</sup> Capt Michael A. Greiner, USAF et al., "An Assessment of Air Force Development Portfolio Management Practices," *Acquisition Review Quarterly* (Spring 2002): 129.

<sup>51</sup> Robert Cooper, Scott Edgett, and Elko Kleinschmidt, "Portfolio management for new product development: results of an industry practices study," *R&D Management* 31, no. 4 (2001): 366-376.

<sup>52</sup> Cooper et al. (2000), 27-32.

<sup>53</sup> Brig Gen(S) Snodgrass interview; Col Tedesco interview.

<sup>54</sup> DepSecDef, Defense Acquisition, cover letter.

<sup>55</sup> Maj Gen Hawkins, Changes to the Requirements Generation System.

<sup>56</sup> John Osterholz, Director, Architecture and Interoperability, ASD(C3I) and DoD CIO, "Information Interoperability and Supportability: The Chief Information Officer Perspective" (briefing presented at the 2002 DoD Interoperability Conference, Mesa, AZ, 26 March 2002), 14, on-line, Internet, 14 December 2002, available from <http://www.dtic.mil/ndia/2002interop/osterholz.pdf>.

<sup>57</sup> For instance, the staffing process for Mission Needs Statements; see CJCSI 3170.01B, C-1. Kent and Ochmanek, 2-3, harshly critique this process.

<sup>58</sup> Observations in this and the next paragraph are mainly the author's opinions, based on experience with space systems acquisition programs, architectures, and Air Staff processes. They may not hold universally.

<sup>59</sup> DepSecDef, Defense Acquisition, Attachment 2, 4.

<sup>60</sup> Maj Gen Hawkins, Changes to the Requirements Generation System.

<sup>61</sup> Osterholz, 14.

<sup>62</sup> Quoted in Donnelly, 2. The director's comments were in response to a recent DoD Inspector General (IG) report criticizing progress on joint interoperability.

<sup>63</sup> Edward C. "Pete" Aldridge, "DoD USD(AT&L) 'All Hands'," *Program Manager* (September-October 2002): 71.

<sup>64</sup> Cooper et al. (2000), 28-32. Though the wisdom of commercial practices tends to be oversold in government "reform" initiatives, the nuggets from the business world seem to deserve consideration here.

<sup>65</sup> Ms. Robin Quinlan, Deputy Director, Systems Interoperability, OUSD(AT&L), "Interoperability" (briefing presented at the 2002 DoD Interoperability Conference, Mesa, AZ, 26 March 2002), 23, on-line, Internet, 14 December 2002, available from <http://www.dtic.mil/ndia/2002interop/quinlan.pdf>.

<sup>66</sup> DepSecDef, Defense Acquisition, Attachment 2, 2-3.

<sup>67</sup> It is not clear if Air Force acquisition policy-makers are thinking the same way as OSD in terms of integrating CONOPS, capabilities, architecture, and interoperability logic into milestone decision criteria in a substantial way.

<sup>68</sup> Col Hoapili interview. For instance, many space programs require entire constellations to be deployed to meet even a first increment of capability. Space launch risks have changed little over 40 years.

<sup>69</sup> Issues have ranged from doctrinal semantics ("air" vs. "air and space" vs. "aerospace") to debates over the merits of "aerospace integration" vs. space professional specialization, to funding difficulties among a number of large space programs.

<sup>70</sup> Sen. Bob Smith, "The Challenge of Space Power," *Aerospace Power Journal* (Spring 1999), n.p., on-line, Internet, 10 October 2002, available from <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj99/spr99/smith.html>.

<sup>71</sup> Space Commission, *Report of the Commission to Assess United States National Security Space Management and Organization* (Washington, DC: The Commission, 11 January 2001).

<sup>72</sup> Col Hoapili interview.

<sup>73</sup> Gen Michael E. Ryan, chief of staff, US Air Force, memorandum for ALMAJCOM-FOA-DRU, subject: Development of Future Concepts of Operations (CONOPS) for the Air Force, 2 February 2001. An example of a CONOPS written in compliance with this directive is: Air Force Space Command, *HQ AFSPC Concept of Operations for Counterspace*, Version 3.4 (Peterson AFB, CO: AFSPC/DOY, April 2002).

<sup>74</sup> For instance, next-generation Space Based Infrared Systems (SBIRS), the so-called SBIRS High and SBIRS Low programs, are expected to fit into architectures for missile defense, missile warning, battlespace awareness, and technical intelligence.

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<sup>75</sup> Even that reorganization left responsibility for space-related CONOPS, requirements, and operations policy in other HQ USAF organizations.



## Part 4

### Driving Issues and Challenges

*There's a 0% chance that we've got this 100% right.*

— General John Jumper

The DoD-wide pressures for change have the potential to be mutually reinforcing catalysts for the Air Force's capabilities-based initiatives. However, these pressures could also work against each other and against the AF plans if not harmonized. Gaps in the logic and execution of a modernization framework could allow some of the pressures to destabilize or even undermine the entire structure. Thus, it is important to identify the full range of driving issues inherent in accommodating and balancing the various pressures depicted in Figure 5. The issues and challenges will suggest desirable “enhancements” to the current approach, and also form the basis of top-level evaluation criteria for assessing alternative, enhanced frameworks.

Many issues have been recognized already during the first year of implementing the new CONOPS-driven approach. For instance, the draft report from a March 2002 CONOPS conference suggested the need for “an overarching strategy” and a new planning framework “to address confusion between types of CONOPS.”<sup>1</sup> The same briefing noted several challenges with the Task Force concept and organization:

- Panel structure vs. Champion vs. (MAJCOM) mission area plans
- Integration and interface between Task Force CONOPS

- Champion vs. architect
- Interaction with joint capabilities
- CRRA subjective analysis will be difficult at best to evaluate.<sup>2</sup>

Recent interviews in the Pentagon indicate that many of these questions persist. For instance, in addressing the question of “Task Force Champion vs. architect,” a senior Air Force advisor noted that Task Forces were intended to have an architecture component, but there has been no time to complete any formal work to support platform recommendations; and in terms of architecting know-how, Task Forces are still “the blind leading the blind.”<sup>3</sup> HQ USAF programmers express varying degrees of skepticism about how well the Task Force approach can address the vast scope of issues that programmers must balance; and some MAJCOM programmers are said to be “uncategorically not on board.”<sup>4</sup>

These Air Staff observations illuminate just a subset of the important issues and challenges that lay ahead. To establish a reference frame for capturing the driving issues, it is helpful to use the representation of the AF capabilities-based approach that was presented in Figure 3. In Figure 6, proposed driving issues and challenges are summarized and overlaid on the notional CONOPS-to-capabilities “conversion process.” The intent is to highlight challenges that *remain* as the Task Force CONOPS approach continues its ongoing implementation; not the fundamental issues already addressed, like the platform-centric viewpoint of program and portfolio reviews. This section continues with a summary description of each issue area.

### **Joint Strategic Priorities, Mission Areas, and Operational Concepts**

Despite the widespread agreement on the need for capabilities-based planning, there is no obvious “master plan” for synchronizing joint and Service initiatives to develop interoperable, transformational systems from a capabilities-based perspective. It is not yet clear how the AF

should pursue its transformation agenda via Task Force CONOPS without getting crosswise with larger DoD priorities, Joint Mission Areas and joint operational concepts, and related process initiatives. A recent speaker at Air War College (and retired flag officer) noted the dangers of appearing too Service-oriented vice “working the right combat problems.” He urged that critical challenge missions like urban warfare be embedded in DoD and Service planning documents, to stimulate development of the required capabilities. Otherwise the Services are too likely to fixate on improving performance in traditional missions like maneuver warfare vice pursuing transformational capability that the “challenge missions” demand.

### Figure 6. CONOPS to Capabilities – Driving Issues and Challenges

It behooves the Air Force to engage the joint community aggressively to ensure that the AF initiatives will mesh with DoD and joint priorities—shaping Joint Mission Areas, operational concepts, and mission area integrated architectures, for instance. If the Services are perceived as

“doing their own thing” without playing fully in the interoperability arena, they may add fuel to whatever fires are smoldering to realign the Title 10 authorities they currently hold.

### **Quality and Completeness of the Task Force CONOPS**

As the Air Force’s CONOPS-driven processes begin to take shape, the foundational Task Force CONOPS documents likewise remain as “works in progress.” A number of concerns should be noted to assist in scrutinizing and improving these CONOPS as they mature to support corporate decision-making. These concerns are based on observations from the first tentative steps in the “new approach” as well as some historical tendencies in “future-looking” concepts of operations. The intent is not so much to critique current draft documents, as to identify areas for constructive debate as the CONOPS mature and evolve.

A first concern is the sharp focus on the “toughest” perceived problems and tasks. For instance, General Jumper outlined the context of Global Strike Task Force:

I think the toughest is the Global Strike Task Force, which is an anti-access problem defended by a competent foe, wherever that is. In the world we live in today, you can aggregate at enough of a level to say, ‘I don’t care if it’s Iran, or China, or Iraq, here’s pretty much what you’re going to have to do. You’re going to have to create the conditions for access. Which means probably you’re going to have to be able to roll back tactical ballistic missiles, you’re going to have to be able to roll back cruise missiles, you’re going to have to go after their storage, their transportation, their launch sites. You’re going to have to help the Navy address the mine problem so it can get close enough to be useful, and you’re going to have to be able to do something to get ground forces in if that’s the decision, certainly special operators who you’re going to need to put eyeballs on targets.’ So, in that text right there is pretty much what you have to be able to do. It doesn’t take a whole lot of analysis.<sup>5</sup>

This high-end focus can be viewed as using a type of bounding “point scenario,” albeit a generic one, as the basis for planning. It takes a middle ground in complying with the QDR guidance to move away from threat-based planning toward a capabilities-based model—falling somewhere between planning to specific point scenarios such as the old “Two-Major Theater War scenario,” and a broad set of conditions to include adversaries who rely on surprise, deception, and

asymmetric warfare.<sup>6</sup> Davis recommends considering a much broader “design space” of threats and scenarios in his framework for capabilities-based planning.<sup>7</sup> A “one size fits all” CONOPS tailored to a stressing scenario may not drive an optimal, or even adequate, set of capabilities to be developed for many other future uses of air and space power.

Second, the themes of the set of seven Task Force CONOPS may not “cover the bases” equitably across all critical capabilities the AF will need to provide. There may be too much overlap between some CONOPS, artificially inflating the importance of certain capabilities, and insufficient coverage of other key “niche” issues. Some space control capabilities and information operations might fall into the latter area. If so, this may be a shortcoming of the individual CONOPS, and a concern with the span of the CONOPS set. AF leadership is not too concerned about overlaps and gaps in this early stage. General Jumper views overlaps as a simplifying benefit:

When you go down through the rest of the task forces, Global Mobility, Global Response, everything else, about 80% of what they do is a lesser-included case of what I just said (Global Strike Task Force). So if I get the capabilities to do what I just said, with all the comm and the predictive battlespace awareness and everything that goes into making that happen, I have solved about 80% of the problems that reside in the other Task Force CONOPS, and the part that is not solved are parts like the nuclear deterrence, nuclear safety, making sure the reliability is there, homeland defense, things that we don’t even know about yet, about how we’re going to do urban warfare, things like that are the outriders. But the real tough parts reside right in this core, of Global Strike Task Force.<sup>8</sup>

The chief scientist also cautions against criticizing the CONOPS in terms of “is this the right set or not?” He argues that the benefits of defining *any* new cross-cutting set of viewpoints across such a complex organization as the Air Force outweigh the concerns over completeness and themes chosen.<sup>9</sup> However, an incomplete set of CONOPS themes could hinder full alignment with joint operating concepts being developed at Joint Forces Command and elsewhere.

Therefore an integrating “completeness check” certainly appears worthwhile, as the Task Force CONOPS and CRRA mature in coming iterations.

Third, the drive to keep Task Force CONOPS “pure” in their generic descriptions of desired effects and capabilities may not always be wise. The apparent phobia over mentioning specific systems, platforms or technologies seems overstated, and makes for abstract descriptions.<sup>10</sup> Technologies may stimulate operational concepts, and vice versa, so neither should be viewed in isolation. Experts also note that operational and systems architectures should be developed together, not separately.<sup>11</sup> Rather than biasing the “chicken and egg” arguments too far toward the operational concepts side, it would seem prudent to acknowledge types of candidate systems and technologies (ranging from current to ambitious future) at least as examples in the Task Force CONOPS.

Fourth, CONOPS developers need to be careful not to become too tied to today’s operational conventions and doctrine. While the current best practices present a solid foundation, it is dangerous to assume that this will continue to be the case 10 or 20 years into the future. Examples of behaviors that should send warning signals include building CONOPS “task lists” from the existing “universal” task lists (joint or Air Force) and doctrinal bins.<sup>12</sup> These practices may be useful for independent completeness checks, but the CONOPS must be visionary in addressing challenging combat problems and proposing creative ways to solve them. A template of “universal tasks” will do little to help set priorities or break down the nuances of innovative capability. Many of the current draft Task Force CONOPS have more of the doctrinal, task list-driven character than is probably desirable.<sup>13</sup>

A fifth, related concern has to do with ambiguous definitions and the overall role of “desired effects.” Similar terminology is being used to describe objectives, effects, and

capabilities. A current Task Force Champion noted definitional inconsistency between Task Forces as a major concern.<sup>14</sup> Within each Task Force CONOPS, most of the desired effects would be more at home in a “universal task list” than in a list of strategic outcomes and consequences of military actions.<sup>15</sup> For instance, Global Strike Task Force identifies three “overarching effects”: gain access; neutralize anti-access systems to enable freedom of action for follow-on forces; and exploit, neutralize, and/or destroy adversary high-value capabilities.<sup>16</sup> Sophisticated EBO thinking has not yet proliferated through most of the current Task Force CONOPS. While this may or may not prove to be a dominant concern, it is likely that “desired effects” need more depth of thought to ensure innovative thinking across the spectrum of future challenges. Starting CRRA discussions with “what effects are we trying to create?” may yield different solutions than starting from “what are we trying to do?”—a subtle but important distinction.

Sixth, the amount of detail in the Task Force CONOPS is not yet sufficient to organize a hierarchy and flow down of concepts and tasks to all levels of operations. The CONOPS continue to mature, and some additional detail is being added and documented in the CRRA. However, the CONOPS should ultimately describe a sequencing of tasks and activities sufficient to see end-to-end linkages and connections—the first steps leading toward an operational architecture. They should actively look across stovepipes, describing *how* information sources, shooters (or other “action-takers”), and controllers should work together to achieve effects.<sup>17</sup> As General Jumper states,

If the CONOPS is written properly, it will define how you have to be integrated. It will define how quickly you have to get target information to a cockpit, once the approval of the political leadership has been obtained. It will provide for decision-quality data to lay in front of the political leader, that allows that political leader to make—if that’s what is required—a decision very quickly, in a very crisp format that says yes or no. And then once the yes is given, you’re getting that data directly to cockpits or the warheads which

are already en route to targets. When you start defining that level of integration in a requirement, you're being fairly specific about what it is you need.<sup>18</sup>

CONOPS built upon long lists of “capability to...” statements or universal task lists have not yet reached this desired level of detail or escaped fully from the current stovepipes.

A final concern questions the lack of “alternatives” in developing the Task Force CONOPS, and amplifies the “design space” and completeness concerns. Whereas architectural studies or system concept proposals generally offer a family of alternatives to decision makers (with varying costs, risks, and performance levels), CONOPS are not evidently approached that way. At present, operators capture the future capabilities they believe they will need—which then become the non-negotiable basis for programmatic trades and decisions to best deliver the capabilities. However, it may be just as important to consider alternative concepts of operation, as it is to consider alternative means of providing capabilities within a CONOPS.<sup>19</sup> Current Task Force CONOPS are not presented in terms of options, alternatives, trade space, transitions, or future branch points. Maj Gen Leaf hinted at this issue in his discussion of the “risk assessment” part of the CRRA:

The most difficult part is nailing down what risk means. There's still a tendency for risk assessment teams and Task Force Champions to find risk exists with programs, or even with specific capabilities. I want to broaden that horizon and ask... if “Capability A” is broken (or has a shortfall) and we're not fixing it—so what? ... maybe it's high risk and maybe not.<sup>20</sup>

CONOPS ought to include alternative capability mixes or themes that accept different levels of risk in balancing “current task list” capabilities with hedges against uncertain futures.

A historical illustration of the consequences of precluding alternatives under uncertain conditions was provided by the Air Corps Tactical School development of concepts of high-altitude daylight precision bombing in the early 1930's. These concepts led to CONOPS-driven investment in long-range bombers and the development of a doctrine that underestimated the



lethality of defenses and blunted the priority given to fielding fighter escorts with commensurate range.<sup>21</sup> (This despite Brig Gen Claire Chennault’s vigorous attempts to advocate for more attention to the latter.) The lesson is that a future CONOPS must start with broad assumptions spanning a range of plausible future environments, and align effects and capabilities along the (multiple) vectors that are likely to have robust merits within such an uncertain future.

To summarize, concerns with the draft Task Force CONOPS include limited scenario “design space,” gaps and overlaps in covering AF missions, a phobia about system associations, possible over-reliance on a current/doctrinal lexicon, ambiguous definitions of effects, insufficient level of detail to drive a planning hierarchy, and a lack of operational alternatives. These will deserve attention in future iterations of the Task Force CONOPS and related CONOPS documents. The AF will need to ensure that systems and functions do not fall through the cracks of the capabilities-based framework, and that a complete effects-based vision is established for mid-term and far-term planning.

### **Common Lexicon**

Pressures to transform, to implement effects- and capabilities-based planning, and to develop interoperable joint architectures all come with an associated set of terms and definitions (i.e., jargon). Progress in setting up a common intellectual framework could be stifled by the simple failure to develop common, unambiguous definitions of the key terms. Until the joint lexicon becomes fully interoperable, joint capabilities cannot be expected to do likewise. The list of terms to be defined would be extensive, but must include effects, objectives, tasks, capabilities, ops concepts (joint and Service), mission areas (joint and Service), architecture frameworks, mission area integrated architectures, and other elements of CONOPS and architectural hierarchies. Definitions of “Task Forces” may also need revision or clarification.

The ambiguity in interpreting effects and EBO (“task list” verbs vs. “outcome-oriented” verbs) is one of the more obvious challenges in this area.<sup>22</sup>

### **Roles, Mechanisms, and Accountability for Architectures**

The DoD requirements community introduced the concepts of capstone requirements and Capstone Requirements Documents in the mid-1990’s in response to increased emphases on networked systems (system of systems, family of systems). However, no adequate mechanism was put in place for the Joint Staff, unified commands and Services to “connect the dots” to allocate capstone requirements and determine the need for subordinate Mission Needs Statements, Operational Requirements Documents and programs. The DoD Architecture Framework, and the joint efforts to introduce the Joint Operational Architecture comprised of mission area integrated architectures, responded to this shortcoming. A handful of offices like the DoD Space Architect (now the National Security Space Architect) were also set up to develop and coordinate mission area architectures.

However, these efforts have moved forward slowly, and there remains very little appreciation of the central importance of architectures in linking operational needs to programs—and even less accountability in the processes. The Navy appears to be ahead of the Air Force in its architectural efforts;<sup>23</sup> yet even there, work was described in May 2001 as (1) uncoordinated, non-integrated, incomplete, and non-compliant with the DoD Framework; (2) inconsistent in terminology, fidelity, formats, tools, and data models; (3) mostly ineffective and expressed in powerless, irrelevant documents, and (4) disorganized in terms of unclear roles and responsibilities and lack of a coherent Navy, joint, and DoD view.<sup>24</sup>

The Air Force will face similar challenges in giving “teeth” to its architects and architectures. General Jumper provides a notional vision for an “architecting” process saying

You have to sit down with the scientists, the developers, the testers, the operators—big part operators—in the acquisition community, in order to make these programs come together in useful ways for the CONOPS guy, who’s going to say “I don’t want five workstations, you come to me when you’ve got it on one.”<sup>25</sup>

However, it is not clear who, if anyone, is accountable for the success of particular AF initiatives in the areas of integration, interoperability, and architecture development. While many players are active in these efforts—including the Air Force chief information officer, the deputy chief of staff for Warfighting Integration (HQ USAF/XI), the AF Command and Control and ISR Center, and the 3-star and 4-star review panels associated with Air Force Materiel Command’s “Enterprise Management” initiatives<sup>26</sup>—all seem to be in a role of “adding value, where feasible” to existing processes. None of these seem accountable to achieve any specific objectives. The AF officers charged with integrating Task Force CONOPS, CRRA, and corporate panel processes do not emphasize a role for architectures; nor are they conversant in the plans, intentions, and ongoing activities within AF architect offices.<sup>27</sup>

### **Process Linkages and Common Scorecard**

There are few formal linkages among the major DoD decision support systems—requirements generation, acquisition management, and the PPBS. Decision processes are uncoordinated and non-synchronized. Likewise, imperfect linkages exist between these “control systems” and the defense strategy and policy that supposedly direct them. Both horizontal and vertical “process integration” are issues.

Achieving something close to the level of “integrated portfolio management” described in business best practices would be a lofty goal for DoD or the Air Force (see the Cooper et al. model in Appendix A). Today, milestone reviews in DoD focus on program health, technical maturity, cost, and risk, vice an overall “importance rating” or linkage to AF or DoD strategic objectives. “Kill” decisions are rarely made there; more likely they happen de facto in the PPBS

process or by Congressional action, when money is denied—whether or not the program is at a milestone decision point. Likewise, de facto “go” decisions in the PPBS may grant a “funding wedge” well before any meaningful program or requirements definition exists. PPBS-driven reviews are much less frequent and less thorough than those described in the business best practice. Also, the mainstream PPBS prioritization occurs at the margins, where “new” projects (initiatives and disconnects) are debated. Baseline projects are only examined if offered up as candidate offsets.

These powerful decision support systems lack a unifying discipline and common set of threads among the processes. Architectures could provide linkages, but architects and integrators do not yet play a dominant, or even guiding, role. There is no “common scorecard” used across all processes, at either the DoD or Service level, to ensure consistency in setting priorities and performing assessments. As a Navy officer summarized quite accurately, “we’re trying to build complex, highly networked, integrated, joint multi-platform, multi-system capabilities... without a top-level design, within a patchwork of stove-piped non-integrated processes.”<sup>28</sup> Tremendous pressure is placed on key decision-makers to overcome this problem using human judgment. Shortcomings within each of the key management processes (requirements, acquisition, PPBS) have only served to compound the problem and further impede an efficient, rational modernization process.

### **Current Stovepipes in Acquisition, Requirements, and Planning**

The legacy of vertically configured acquisition and requirements processes is attacked in recent DoD policy changes. Interim “5000 series” policy focuses attention on interoperability, requires capabilities-based strategies, and endorses mission area architectures, roadmaps and assessments.<sup>29</sup> Requirements changes call for replacing Mission Needs Statements with a

mission-area focused, capabilities-based document.<sup>30</sup> Even as these changes are made, integration among decision processes will likely continue to be a major challenge. It remains to be seen how well the central authorities—such as the Joint Requirements Oversight Council and the Defense Acquisition Board—will be able to evaluate cross-program tradeoffs. Moreover, the process of getting new concepts “into the mix” will remain challenged by existing barriers.

Currently, the Program Element Monitors (PEM) and acquisition mission directorates wield considerable power in the concept pipeline, being key providers of information to the Air Force corporate panels, to DoD program reviews, and to Congress. Influence and power in the Pentagon tend to flow through “who has the money and who prepares the decision packages.”<sup>31</sup> This is not necessarily a bad situation, but given that PEMs operate within tight constraints of the DoD program element structure, congressional reporting requirements, and a stove-piped milestone decision process, this impedes the implementation of capabilities-based thinking—especially early in the “life” of a material concept. A look at where PEMs sit and to whom they report (as a function of where a concept or program stands in its life cycle) is warranted. To steer money to promising projects, the “concept generation” PEM function should be aligned with capability “thinkers,” and be sufficiently agile—that is, not too constrained by acquisition management formalities, not overly bound by existing PPBS and Congressional reporting “culture,” but still within the bounds of law and regulation.<sup>32</sup>

Meanwhile, Air Force long-range planners have had relatively little “power” (or accountability) in influencing decisions to support new concepts—despite being responsible for transformational strategy and official AF planning documents. Strategic plans have been more closely connected to abstract “vision forces,” doctrinal vectors and futures wargames than to shaping capability investment decisions. Planners and programmers work for the same deputy

chief of staff (HQ USAF/XP), yet a huge gap exists between plans and programming decisions. The gap is currently filled by information supplied by PEMs, “functional expert” offices, and the “requirements community” (with their respective MAJCOM contacts.)

The AF requirements developers, led by HQ USAF/XOR, have exerted an intermediate level of influence; not just through the new CRRA process, but also through the traditional staffing of requirements documents (Mission Needs Statements and Operational Requirements Documents) that were required for concepts to move forward into development. Of course, the requirements processes are undergoing DoD-directed changes, and should evolve to a more capabilities-based focus. However, the cultural barriers created by the legacy stovepipes in acquisition, requirements, and planning will take time and determination to erode. It is worthwhile to consider options to realign “concept PEM,” “long range planning” and “future ops concept and mission need” functions into a more coherent, capabilities-based structure. These functions are currently fragmented in the AF organization, across HQ USAF directorates (for acquisition, plans, and operational requirements), MAJCOMs, and other functional offices as well as in the new undersecretary of the Air Force space management structure.

### **Corporate Organizational Alignment**

A related but broader issue concerns the alignment of organizations with critical roles in capabilities-based modernization. The challenge of organizing for coherent “new concept sponsorship” was already suggested. Another challenge is to align properly for “mission area architecting.” Multiple AF offices and entities already have some chartered responsibility for architecting functions, with varied purposes—for instance, leading development of AF information technology, pursuing ways to better integrate warfighting systems, and working cross-cutting acquisition program issues.<sup>33</sup> Meanwhile, risk assessment teams in the CRRA are

performing de facto architecting to augment the intellectual structure of the Task Force CONOPS to a sufficient degree to enable a capabilities review. The question of “who’s in charge” certainly applies in the architectural domain.

The AF has introduced headquarters-level “architecture councils” as an organizational construct to support the range of demands for architectures—spanning warfighting, combat support, business processes, and “infostructure.”<sup>34</sup> These councils do not currently align in an obvious way with the Task Force structure or even the corporate panel structure. As a result, the alignment matrix becomes a three-dimensional “Rubik’s cube” and adds to the already-difficult road faced in infusing architectural thinking into mainstream AF processes.

Even within the “architecture-knowledgeable” community, organizational responsibility for the operational and systems viewpoints is fragmented. The AF chief scientist emphasizes the importance of developing ops architecture and systems architecture *together*. Yet in both the joint and AF arenas, responsibilities are divided.<sup>35</sup> While senior leaders are said to understand this issue, official policy tends to endorse separation. The risks of such split responsibilities include the tendency for operators to fix today’s problems at the expense of conceptualizing for the future.<sup>36</sup>

Other organizational questions will need to be answered in seeking the best ways to connect CONOPS to capabilities. For instance, who defines the breakdown of the overall Air Force mission into Task Forces, their sub-missions, and any “outlying” missions? Who defines relationships between AF missions and Joint Mission Areas? Who is in charge of developing and maintaining a standardized, objective assessment framework that crosses Task Forces and mission areas? These functions are apparently fragmented among Air Staff operators, long-

range planners, and integrators, and MAJCOM offices and centers. The best “home” for these functions remains a matter of debate.

Of course, MAJCOMs, laboratories, and other field entities must also mesh into any sort of integrated construct for “concept stewardship” or “mission area architecting.” Already, many stakeholders are not linked to key decisions and processes. There will obviously be tensions between proponents of stronger headquarters-based focus and leadership, and those who favor decentralization of most functions to the MAJCOM level and below.

### **Buy-In at All Levels of Stakeholders**

Securing wide consensus on the wisdom of headquarters-directed initiatives is never a given. To overcome the natural cultural resistance to change, new approaches to add a “unifying context” to CONOPS development, architecture management, concept advocacy, and assessment processes will need to be appealing and intuitive to stakeholders. Processes will need to smoothly integrate vertically in the AF organizational chain.

Some of the stiffest resistance to capabilities-based planning may come from established owners of pieces of the AF budget (i.e., the MAJCOMs), from program offices, and especially from industry, since defense contractors’ interests are best served by winning large stand-alone system contracts. Senior military officers are recognizing this inertia. An Army Program Executive Officer warned industry that companies should not expect future work unless they see their products not as stand-alone systems, but as part of a network or system of systems.<sup>37</sup> The CSAF also described his “challenge” with getting industry on board:

I’m already seeing it with the companies. The CEOs are already marching in here and saying “you’re killing me, I don’t have a single point of contact anymore, I can’t do it my old comfortable way,” and I say “good, it’s working, go work up a sweat and figure out how to solve the problem, and don’t come back with me here and tell me that you want to do it the old way, the platform way anyway, because quite frankly I don’t care if it’s in space or the air.” I’ve gotten word that they’re having meetings about, well they’ll just



outlast me, and I'll go away and we'll get back to the platform orientation, and when they do that I call them up and say "I hear you just had a meeting; let me tell you what, we're not doing business with you anymore." [Then they say] "OK, oh no, we'll [cooperate]"<sup>38</sup>

Stakeholder inertia is understandable though, considering that it is difficult to appreciate the evolving "big picture" of the Task Force initiatives from outside the Pentagon. "Outsider" perceptions include observable shortcomings in the draft CONOPS, unclear fit of Task Force CONOPS structures with corporate and MAJCOM-centered processes, questionable rigor of the CRRA and overall end-to-end process, and concern about the headquarters encroaching on already-limited MAJCOM freedom of action. In contrast, "insiders" can see good ideas emerging and evidence of steady progress in linking the CONOPS, CRRA, and corporate processes. Programmers and Task Force Champions seem to agree that the many moving parts are slowly coming into alignment, with great potential to cascade into a new way of doing business. Overcoming these perception mismatches will require N-fold "over-communication" of the vision and progress, and strong leadership commitment at all levels.

### **Overall Portfolio Balance and Integration Among Missions**

The Air Force corporate process is challenged to balance and integrate among the resource demands of modernization portfolios, as they also compete with infrastructure, combat support, operational readiness, and other issues. Davis asserts that the problem has "no general solutions, nor is there any way to be rigorous."<sup>39</sup> This challenge was at the heart of several Air Force reorganizations since 1989 that attempted to better distribute responsibilities for planning and programming. As POM-building duties were delegated to the MAJCOMs, an extreme burden was left on the chief of staff and secretary of the Air Force to make the key balancing judgments and decisions.<sup>40</sup> Although the chief and secretary are supported by the corporate board structure and the "independent" viewpoint of the Air Staff programming community, the

decentralized nature of the current POM-building process limits the effectiveness of centralized balancing and integration.

A recent survey of key players in the Air Force corporate process identified numerous impediments to effective centralized portfolio management. Among the major problems cited were (1) lack of means to ensure strategic alignment of programs, (2) sparse information to support high-level decision-making, (3) lack of decision support tools, (4) inadequate feedback controls in the process, (5) limited ability to measure the value, risk and uncertainty of programs, (6) failure to integrate across the AF portfolio, (7) difficulty in killing programs that deserve to be killed, and (8) cultural factors such as program advocacy and risk averse behaviors.<sup>41</sup> (Note that the CRRA process will help address many, but not all of these issues.) While these problems overlap with other issues identified in this chapter, the underlying theme is, a lack of analytical depth and capability to support the centralized authority that is responsible for integrative assessments across the overall Air Force portfolio. The chief and secretary are pressured severely to make resource decisions with far-from-perfect data and context. This situation was partly caused by directed reductions in Headquarters USAF staffs that forced decentralization of most functions to the MAJCOMs.<sup>42</sup> Somehow the corporate process needs to be strengthened with better analytical tools, architectural context, and interdependency assessments to improve on current practices.

### **Ensure Innovation, Flexibility vs. Uncertainty**

A modular, “building-block” approach to developing capabilities will have inherent advantages in flexibility and adaptability to change. New DoD acquisition policy and AF Materiel Command “Agile Acquisition” and “Enterprise Management” are examples of initiatives that should enable more rapid deliveries of capability to warfighters in response to

dynamic change.<sup>43</sup> However, a fundamental transformation dilemma is to begin investing in promising future capabilities while remaining open to alternative transformation paths. Since threats and environments will not be fully known in advance, there is a risk of false starts wasting valuable resources.<sup>44</sup>

DoD shares this challenge with business product development: how to best guide resource distribution among near term, “urgent” projects and longer-term efforts, high and low risk projects, and new products versus modifications and fixes to current ones? As pointed out by Cooper et al., lack of conscious balance (e.g., using “strategic buckets”) among such projects gives predictable results: “the quick, short-term, and well-defined extensions, modifications and fixes win out in the competition for resources, often to the longer-term detriment of the business.”<sup>45</sup> Likewise, Air Force and DoD capabilities-based portfolio reviews need to be wary that the myriad requirements for near-term fixes do not overwhelm investment in future concepts. Despite the pressures to “transform,” today’s plans for longer-term technology investments—including Service and MAJCOM strategic plans, mission area plans, and the National Security Space Master Plan—are not treated as “authoritative” and are likely to lose out to near-term priorities in the programming and budgeting phases of PPBS. Without more balance and “teeth” in the strategic planning dimension, DoD portfolios will lack the flexibility to anticipate and respond to strategic developments.

A sound methodology to plan under uncertainties is clearly important. The “alternative futures” method used in AF 2025 studies is one example of such a method, and other sophisticated computer-assisted techniques are becoming available.<sup>46</sup> Westphal et al. emphasize the importance of viewing strategic planning as a dynamic, adaptive *process* and not as an end product (the plan). Plans must constantly envision adversary “antiplans” and adjust

accordingly.<sup>47</sup> To derive strategies and capabilities that are robust to uncertain future threats, “design space” should be based on plausible threats and their consequences, vice the traditional approach that weighs threat “likelihood.”<sup>48</sup> Such methods and guidelines should be incorporated into any analytical framework adopted by AF Task Force teams for use in the CRRA and other assessments. Assessment criteria and value judgments must strike a balance between “clear near-term benefit” and “flexibility to hedge against future changes.”

### **Analytical Rigor and Data Quality**

Beyond the need to account for uncertainty and “design space,” assessment teams will need to agree on a realistic and “standardized” analytical framework, including methodology, evaluation criteria, tools, and data formats. Ideally, the framework would lead to a “common scorecard” that could be used in CRRA, PPBS prioritizations, acquisition decisions, architecture development, requirements development, and even test and evaluation measures. Supporting modeling and simulation tools need to be tailored to the appropriate capability “domain” or building block level vice the traditional campaign level. A crucial challenge is to model and assess interdependencies, since “current PPBS practice does not recognize the interdependencies that are needed for network centric operations” (i.e., for capabilities- and architecture-based planning and programming).<sup>49</sup> This will be difficult within Task Forces, let alone for AF or DoD-wide portfolios.

Another broad issue involves the quality of project data that is available to corporate review processes. Describing a project via a single cryptic “RAPIDS chart” is cited as a major impediment to effective corporate decision-making.<sup>50</sup> An inherent difficulty with the long-lead-time nature of the PPBS is that program sponsors must often fight to get “funding wedges” well before any meaningful program definition exists. Nevertheless, some programs “do the

homework” better than others, so decisions are made on a mix of good and bad data. Imposing more uniform standards on the quality and quantity of data coming from MAJCOMs and program offices would facilitate more objective value assessments. A “common scorecard” may be the key to these standards and may define the template for the next-generation RAPIDS chart(s). The integrity of any proposal for a more integrated portfolio management framework will depend on a means to share data of higher and more uniform quality.

### **Air Force vs. OSD and Joint Assessment Roles and Processes**

The CRRA process aspires to become the Air Force’s primary assessment and feedback mechanism, to implement a capabilities-based evaluation of programs to support resource decisions. The scope, timing, methods and criteria of the CRRA are still emerging. These may or may not synchronize well with the approaches used in OSD and joint portfolio reviews. The latter could range from the traditional, annual, issue-oriented program and budget reviews (that lead to Program Decision Memoranda and Program Budget Decisions), to the architecture-level capability assessments called for in the new defense acquisition policy. The strategy to implement joint architecture-based reviews is not yet defined. If new joint reviews do materialize (which is not a certainty), they will likely succeed only if a stable structure is in place linking joint and Service-developed architectures and roadmaps.

The “National Security Space Program Assessment” provides a further complication. This annual review effort, led by the undersecretary of the Air Force as Executive Agent for Space, considers joint and national priorities in assessing the combined Service and agency space portfolio and POM submissions. Experience from the first two program assessments in 2001 and 2002 has shown the importance of synchronizing timing with OSD’s program review. It also showed that recommendations could conflict with those coming from AF and/or OSD reviews.<sup>51</sup>

Already, Air Force leaders are concerned about program review clashes with OSD interests, especially when factions in OSD “want to take control of the money, and be directive in the programs.”<sup>52</sup> Such tensions are predictable given that OSD, joint, and Air Force mission- and functional-level entities use different criteria and “scorecards” in their portfolio reviews, whether formal or informal. The underlying AF and DoD goals may not be fully consistent in content, priorities, or in how they are broken out and translated into a “definition of success” in a framework suitable for analysis. The methods used to analyze and assess may range from being highly subjective and politically driven to being more objective and rigorous—but the vision of “fully rigorous” decision support will remain impractical for anyone to achieve.

### **Cost-Effective Business Practice**

Although DoD reform efforts have taken a (fortunate) turn away from business process reform and moved toward a mission capabilities focus, there is still an obvious interest in ensuring efficiency and cost-effectiveness in DoD practices. For instance, evolutionary acquisition aims at least partly to manage individual program risk and lessen the likelihood of major failures and cost overruns. The broader cost impacts of the Air Force’s Task Force approach and other capabilities-based initiatives remain to be seen. At least three challenges are apparent in the quest for cost-effective, centralized portfolio management.

First, pressures to get new concepts into the “rapid acquisition” pipeline will need to be counterbalanced by an efficient go/kill assessment process. If candidate acquisition programs continue to be scrutinized mainly on their own merits, too many programs may continue to pass their initial go/kill milestones and then have to compete for scarce resources. Consequently, overall efficiency will depend on the degree to which the Air Force and DoD can integrate portfolio reviews, acquisition milestones, and PPBS resource decisions, as suggested in Cooper

et al.'s framework.<sup>53</sup> Second, the degree to which AF programmers can leverage inputs from the Task Force Champions to help find offsets, bound trade spaces, and make difficult decisions, will determine if the Task Force approach is a beneficial business practice. If Task Forces are seen mainly as advocates for suites of programs that add to funding demands, and prove hesitant to accept risks in some areas, the benefits of the approach will be more questionable. Finally, architectures have yet to prove their merits in terms of fostering efficiency—though this was certainly a hypothesis of the Clinger-Cohen act and subsequent direction to employ the DoD Architecture Framework. Architecture development may prove so cumbersome and time-consuming that it adds costs and complexity if “overdone”—it is probably too soon to tell.

## Notes

<sup>1</sup> This comment refers to Air Force Policy Directive (AFPD) 10-28, *CONOPS Development*, 8 January 2002, which until recently was the approved Air Force policy for CONOPS and defined a hierarchy of documents including CONOPS, Concept(s) of Employment (CONEMP), and Concept(s) of Execution (CONEX). According to the AF CONOPS web site, the current version of AFPD 10-28 has been overcome by the CSAF's Task Force CONOPS initiative, but a new AFPD has yet to take its place.

<sup>2</sup> Col Mike “Mobile” Holmes, HQ USAF/XOXS, “Task Force CONOPS MAJCOM Conference After Action Report” (draft briefing, Washington, DC: USAF/XOXS, 11 March 2002), 5, 9-10.

<sup>3</sup> Dr. Levis interview.

<sup>4</sup> Observation made by a Task Force Champion during an interview by author, 17 December 2002.

<sup>5</sup> Gen Jumper interview.

<sup>6</sup> *QDR Report*, iv.

<sup>7</sup> Davis, xi-xiv.

<sup>8</sup> Gen Jumper interview. Maj Gen Leaf also notes a “40-70% overlap” between CONOPS, and admits they are not exhaustive in their coverage.

<sup>9</sup> Dr. Levis interview.

<sup>10</sup> Further, there is a danger that “capability terminology” will take on an aura of political correctness. To insist on using capability abstractions in every planning endeavor will doubtless prove confusing and nebulous at times. Just as the chief uses examples like integrated workstations and the F/A-22 to explain his capabilities-based vision, CONOPS should not hesitate to clarify ideas by mentioning candidate platforms or systems, at least at the level of “a stealthy aircraft,” “a satellite,” “a ground terminal,” or “a workstation.”

<sup>11</sup> Ibid.

<sup>12</sup> Especially when some of the doctrinal bins lack content, as is the case with the immature areas of offensive and defensive counterspace.

<sup>13</sup> For instance, the Global Strike, Global Response, Homeland Security, and Nuclear Response Task Force CONOPS have adopted a common format for a “macro capabilities list” appendix built from the Air Force Task List and other C4ISR functions. This is used to identify overlaps among CONOPS and also as a structure to organize expanded descriptions of capabilities.

<sup>14</sup> Col Robert Gordon, Space and C4ISR Task Force Champion, interviewed by author, 18 December 2002.

<sup>15</sup> The C4ISR and Global Mobility CONOPS would be expected to be less EBO-driven, since its objectives involve the quality, timeliness and completeness of support to other Task Forces with more direct effects on adversary behavior. However, even the “pointy end” CONOPS describe effects in terms of traditional military tasks and objectives. Only the Homeland Security Task Force CONOPS includes a more thorough discussion of effects.

## Notes

<sup>16</sup> Air Combat Command, *Global Strike Task Force CONOPS*, Version 2.0 (ACC/XPS, 26 July 2002), 5, on-line, Internet, 2 December 2002, available from AF CONOPS website at <https://afconops.hq.af.mil/support/index3.htm>.

<sup>17</sup> Mr. Robert Preston, RAND, interviewed by author, 17 December 2002.

<sup>18</sup> Gen Jumper interview.

<sup>19</sup> For instance, in transitioning from a terrestrial-based network for surveillance of space to a space-based architecture, a fundamental change in CONOPS may be appropriate to fully exploit the potential of the new capability.

<sup>20</sup> Maj Gen Leaf interview.

<sup>21</sup> Thomas H. Greer, *The Development of Air Doctrine in the Army Air Arm 1917-1941* (1955; reprint, Washington, DC: Office of Air Force History, 1985), 55-60.

<sup>22</sup> Air Combat Command's white paper on EBO is a good start toward setting a common lexicon.

<sup>23</sup> Dr. Levis interview.

<sup>24</sup> Yurchak, 7.

<sup>25</sup> Gen Jumper interview.

<sup>26</sup> An introduction to the "Enterprise Management" initiative is given by Maj Gen Michael Wiedemer, "AFMC leads AF transformation initiatives," *AFMC Leading Edge* (April 2002): 4-5, on-line, Internet, 14 December 2002, available from [http://www.afmc.wpafb.af.mil/HQ-AFMC/PA/leading\\_edge/archives/2002/apr/April%202002.pdf](http://www.afmc.wpafb.af.mil/HQ-AFMC/PA/leading_edge/archives/2002/apr/April%202002.pdf). Current crosscutting issues getting 3- and 4-star attention were described by Maj Gen John L. Barry, AFMC/XP, "Predictive Support Awareness" (briefing presented at Air War College, Maxwell AFB, AL, 15 January 2003).

<sup>27</sup> Brig Gen(S) Snodgrass interview, Col Tedesco interview, Col Gordon interview. It was noted, however, that AF/XI provided analytical support to the Space and C4ISR CRRA, and a very recent requirements briefing describes the CRRA process as providing a continuous review of CONOPS, capabilities, investment priorities, and architectures; see Budgeon, 10.

<sup>28</sup> Yurchak, 2.

<sup>29</sup> DepSecDef, Defense Acquisition, Attachment 2, 2-4.

<sup>30</sup> Maj Gen Hawkins, Changes to the Requirements Generation System.

<sup>31</sup> Preston interview.

<sup>32</sup> A similar idea appeared in the Secretary of Defense program direction establishing the Missile Defense Agency, wherein the agency was given latitude to conduct research and development activities without some of the traditional constraints of the requirements and acquisition systems. Programs are to be handed off to Services for procurement after initial development is complete. See Secretary of Defense, memorandum for Deputy Secretary of Defense, Secretaries of the Military Departments et al., subject: Missile Defense Program Direction, 2 January 2002, on-line, Internet, 9 February 2003, available from <http://www.defenselink.mil/news/Jan2002/d20020102mda.pdf>.

<sup>33</sup> These are the respective lead roles of the chief information officer's chief architect office (AF-CIO/A), the deputy chief of staff for Warfighting Integration (HQ USAF/XI), and AFMC "Enterprise Managers."

<sup>34</sup> US Air Force, "Air Force Enterprise Architectures" (briefing, Washington DC: AF CIO/A and AF/XIW, 17 December 2002), 11-12; Lt Gen Woodward, 7.

<sup>35</sup> For instance, Joint Staff and JFCOM documents emphasize joint operational concepts and Joint Operational Architecture, usually with no mention of associated systems architectures. The new DoD 5000 guidance directs the Joint Staff to lead development of the operational view, while USD(AT&L) is to lead development of the systems view. In the AF, Dr. Levis noted a split in ops and system architecture responsibilities between the AF Command and Control and ISR Center and the Aeronautical Systems Center. Air Force Materiel Command's Enterprise Management initiative identifies lead centers for crosscutting system solutions, interoperability and SoS architecture issues—clearly from a systems perspective. The author also experienced this mindset when assigned to the DoD Space Architect, where the architect focused on systems architectures and assumed that US Space Command was responsible for associated operational architectures—which were not even developed in parallel.

<sup>36</sup> Dr. Levis interview.

<sup>37</sup> Frank Tiboni, "Top U.S. Army Program Officer Warns Industry: Make Products Network-Centric or Take a Hike," *Defense News* (3 December 2002), n.p., on-line, Internet, 14 December 2002, available from <http://ebird.dtic.mil/Dec2002/s20021204139955.html>.

<sup>38</sup> Gen Jumper interview.



## Notes

<sup>39</sup> Davis, 43. He also identifies four causes of difficulty: (1) system complexity; (2) need for numerous subjective judgments; (3) many legitimate considerations for defense expenditures other than combat capability; and (4) a constantly changing environment.

<sup>40</sup> Lewis et al., 61-79.

<sup>41</sup> Greiner et al., 126-136. The study also assessed industry best practices for possible application in correcting some of the deficiencies.

<sup>42</sup> Lewis et al., 61-69.

<sup>43</sup> "Materiel Provider QA: Interview with Gen. Lester L. Lyles," *Military Aerospace Technology* 1, no. 3 (July 2002), n.p., on-line, Internet, 13 December 2002, available from [http://www.matkmi.com/Archives/1\\_3\\_MAT/1\\_3\\_QA.cfm](http://www.matkmi.com/Archives/1_3_MAT/1_3_QA.cfm).

<sup>44</sup> DoD, Transformation Planning Guidance, 16.

<sup>45</sup> Cooper et al. (2000), 23.

<sup>46</sup> For instance, Robert J. Lempert, "A new decision sciences for complex systems," *Proc. Natl. Acad. Sci. USA* 99, suppl. 3 (14 May 2002): 7309-7313, on-line, Internet, available from <http://www.pnas.org/cgi/doi/10.1073/pnas.082081699>; and Robert J. Lempert, Steven W. Popper, and Steven C. Banks, "Confronting Surprise," *Social Science Computer Review* 20, no. 4 (Winter 2002): 420:440.

<sup>47</sup> Deborah L. Westphal, Richard Szafranski, and Dr. Gregory S. Parnell, "Strategic Planning for the Air Force," *Airpower Journal* (Winter 1998): 30-39.

<sup>48</sup> Preston interview, discussion of ongoing defensive space control analysis, 17 December 2002.

<sup>49</sup> Osterholz, 14.

<sup>50</sup> Greiner et al., 127, 129. The chart uses a standard format to present information from the Resource Allocation Programming Information Decision System (RAPIDS).

<sup>51</sup> Col Hoapili interview; and Col Doug Owens, chief, Integration Division, National Security Space Architect, interviewed by author, 17 December 2002. The author also served as an IPT lead for the first NSSPA.

<sup>52</sup> Gen Jumper interview.

<sup>53</sup> Cooper et al. (2000), 19-22, 28-32.

## **Part 5**

### **Scope and Success Criteria for a Comprehensive Framework**

From the foregoing discussions, it is possible to imagine a hypothetical situation in which the large majority of issues are resolved, and the pressures for change are appropriately balanced. The resulting model can be viewed as an outline for an “ideal” modernization framework—a complete set of processes, steps, and activities to implement robust capabilities-based planning. The emphasis will be to establish the scope of such a comprehensive model, outlining “what” needs to be done rather than the details of “how” it would be implemented, “who” the major players would be, and so forth. These details would be part of any practical approach, which may have to settle for a considerably less ambitious end state. The scoping model does provide an objective “vision of success” to use in evaluating more feasible alternatives.

#### **The Scoping Model**

The “ideal” model should (1) provide complete coverage of key process objectives across PPBS, acquisition, etc., (2) balance and harmonize the “pressures,” and (3) recognize and address the issues and challenges where possible, to minimize gaps in the framework. It should also be consistent with an aggregation of “best practice” process steps from existing comprehensive frameworks such as those summarized in Appendix A. Note that some of the elements of the scoping model are already in place today; others exist only partially, and some are absent altogether. The suggested elements, not necessarily in a sequential order, are to:

- Comprehensively identify stressing missions, objectives, ops challenges—including a linkage and hierarchy among Joint Mission Areas, Task Force missions, and subordinate “capability package” level missions or sub-missions
- Assimilate strategic guidance on the priorities for addressing the stressing missions and challenges, and the desired strategic balance among legacy vs. new capability, research and development vs. current readiness and sustainment, short vs. long term, and high vs. low risk; reconcile joint/Service differences, then communicate guidance vertically and horizontally
- Develop concepts of operation sufficient to describe robust approaches to each challenge; include effects-based, sequenced actions, with adequate “design space” (preserving options and trade space where appropriate), broken out in a hierarchy sufficient to organize and drive lower-level CONOPS
- Augment CONOPS with other capstone-level needs/requirements where appropriate, to describe how well critical tasks must be performed within the capability package missions and sub-missions
- Expand/decompose CONOPS into key capability components (functional, organizational, task; sequenced actions among actors)—sufficiently detailed to determine an operational architecture; including options or evolution paths
- Develop CONOPS-driven mission-level or capability package level architecture needed to generate required capabilities for each mission/challenge; concurrently derive the operational and systems architecture (or system-of-systems/family-of-systems description), including legacy and new systems, and including options or evolution paths
- Develop and evaluate options to determine an “optimal” architecture or system of systems, preserving flexibility and trade space in the specific system solutions
- Lay out a “baseline” roadmap of capabilities and systems governed by funding, available technology, and priority, i.e., a mission/challenge investment plan (could also be functional, like National Security Space Master Plan)
- Develop an enduring scoring or ranking system for prioritizing programs/technology within the mission or capability package and within the overall portfolio; based on strategic value in meeting the missions/challenges, ability to fill gaps, balance risk, etc.; with consistent joint/Service criteria; supported by appropriate analysis tools, including modeling and simulation
- Conduct timely periodic reviews of all programs in the portfolio, establish/update ranking or prioritization based on agreed joint/Service criteria and strategic priorities, and uniform quality program data; use this to stimulate architecture/roadmap updates and to feed PPBS recommendations

- Integrate and balance across systems-of-systems, architectures, missions to ensure AF and joint interoperability, synergy, etc.; identify cross-cutting issues and interdependencies during periodic reviews
- Develop and refine lower-level CONOPS (e.g., concepts of employment and concepts of execution for capability packages; system or functional CONOPS to fill gaps in Task Force CONOPS) to guide requirements and architectures for specific capabilities, tasks, sub-missions, and systems
- Derive system-level CONOPS, incremental requirements, and time-phased solutions (materiel and non-materiel) consistent with capability-level or system-of-systems-level architecture and requirements
- Acquire systems using an evolutionary acquisition and requirements strategy
- Use acquisition milestone reviews and project portfolio reviews (at the capability package level and Task Force level) in an integrated fashion to assess program health *and* establish/update “value” and priority based on the common scoring/ranking system; provide rationale and authority for more dynamic go/kill decisions
- Implement robust technology and concept development mechanisms to ensure alignment with strategic and capability priorities; coarsely screen concepts via common scoring method; yet maintain broad coverage of options to hedge against uncertain future developments.

Again, this model is not the “final answer” sought in the research questions. It summarizes the scope of activities and desired outcomes that a realistic framework should strive to address. In a sense, it is the macro “process CONOPS” that states broad “objective requirements” for a modernization framework.<sup>1</sup> To design and assess realistic alternative frameworks involves tradeoffs, and looks to achieve “threshold levels” of success in the process steps. Alternatives will be based on various themes and organizational emphases that consider details of how to work toward “ideal” status, to varying degrees, in many or all of the steps.

## **Evaluation Criteria**

As an “objective-level” framework, the scoping model assists in identifying appropriate criteria for evaluating the merits of a (less ambitious) candidate framework. Discussions in the paper have identified a wide range of objectives and challenges that could serve as the basis for

evaluation criteria. To distill these to a manageable list, the structure in Table 1 is proposed. It includes nine “rolled up” criteria that organize the much wider set of possible objectives and “success measures” for a candidate modernization framework.

**Table 1. Evaluation Criteria for Alternative Capabilities-Based Frameworks**

Evaluation Criteria	Descriptors and Attributes
Horizontal Process Integration	Foster links between acquisition, requirements, PPBS process Reduce traditional stovepipes Coherence with joint and DoD review/assessment processes Common scorecards for decision support
Vertical Process Integration	Clear roles of HQ and MAJCOMS, labs and industry Clear authorities to develop, integrate, validate, approve Better quality data provided to decision-makers Better top-to-bottom communications of guidance & info Foster unity of purpose & buy-in throughout AF and industry
Horizontal Mission Integration	Completeness across missions, scenarios, etc. Establish common lexicon for effects, capabilities, etc. Identify interdependencies, use in evaluations Balance & tradeoffs across task forces, panels, etc. Fosters ops & system integration—fusion, machine/machine Joint interoperability, compliance with accepted frameworks
Vertical Mission Integration	Fosters innovative concepts & integration for effects-based ops Clear hierarchy of CONOPS & mission definition Connects CONOPS to architecture, capabilities & programs “One architect” for operational & systems architectures Provides system-of-system architecting & engineering Provides vectors for technology, without over-constraining
Strategic Priorities & Focus	Fosters alignment with QDR, DPG, Global VRP, JV 2020 Synthesize top-down guidance for consumers of AF plans Establish criteria for common scorecards, with joint consensus Capabilities & effects-based lexicon vice platforms/programs
Innovation & Flexibility	Degree of transformation Sets vision to challenge concept developers Fosters flexibility to changing threat, environment Assessment methods incorporate risk & uncertainty Preserves alternatives in operational & systems solutions Balance of near-term and longer-term concepts & investments
Efficiency	Fosters tradeoffs and “kills” to conserve scarce resources Rigorous & objective analytical structure Use & improvement of decision support tools Improve business practices: acquisition & portfolio mgmt
Organizational Viability	Ease to implement required organizational changes Minimal policy change required

	Appropriate balance of power/effort—horizontal Appropriate balance of power/effort—vertical Alignment of organizations with “driving” functions
Process Suitability	Clarity of process & unifying context Simplicity & ease of use at all levels Personnel skills exist, little specialized training required Tools/methods involved are not cumbersome Reasonable demands on decision-maker time & involvement Adaptability & robustness to changing circumstances

These criteria are not exhaustive and the binning is certainly not unique, but the set intersects almost all of the objectives, pressures and issues identified earlier. The overlaps in the criteria and their attributes mean that an alternative framework that emphasizes a particular theme, like maximizing horizontal and vertical mission integration, will have some secondary and cascading effects across other criteria—some good, some bad. For instance, an emphasis on architecture development will also impact the fidelity of the CONOPS and capability hierarchy, analytical rigor, process clarity and burden, and other attributes.

An immediate question is whether or not the criteria should be weighted or prioritized. Some may be viewed as particularly critical, for instance: strategic alignment (what is most important?), vertical mission integration and innovation/flexibility (which focus on delivering warfighting capability), and process suitability (otherwise change will not happen). If used, a weighting scheme should favor mission capability over business efficiency—a prioritization that 9/11 has helped refocus from the reform initiatives of the past decade. For this coarse-grained “process analysis” though, it seems appropriate to give the criteria approximately equal consideration in the assessment of candidate frameworks.

## Notes

<sup>1</sup> Where “objective requirement” is used in the traditional context of a desired level of capability that may be significantly above the minimum acceptable (threshold) level.

## **Part 6**

### **What Path to Take? Alternative “Vectors”**

The preceding sections identified a range of driving problems and influences. One approach to resolving the issues would be to simply propose a solution to each issue and build an aggregate “way ahead” as a composite of steps to implement the solutions—possibly in priority order. Those steps would become the final recommendations as well. However, this approach would risk losing sight of the “big picture,” both in terms of the strategy for addressing groups of issues, and the unifying theme(s) for recommended process and organizational changes.

A more careful approach is to define and evaluate a set of “integrated methodology” alternatives, as a systematic mechanism for gauging the pros and cons of potential incremental solutions. This will yield insights into the most attractive overall theme(s) for change, in addition to suggesting the best composite steps and recommendations to address issues. This approach ensures consideration of a full trade space of “directions” that might be taken, and allows those directions to be better grounded in supporting research results. Most of the alternatives leverage approaches either taken in other organizations, or recommended by researchers to address similar questions. Namely, how best to make portfolio investment decisions in a manner aligned with strategic objectives? Appendix A summarizes the referenced approaches.

In describing each alternative vector, key features will be highlighted; but each framework is assumed to be a “delta” from the existing “legacy” processes. Thus, it is “rounded out” by allowing it to maintain current actors and products (panels, MAPs, etc.) unless the theme specifically replaces these with “stronger” constructs or clear changes to focus and organization.

### **Alternative 1: MAJCOM and Panel-Driven “As-Is” Processes**

This alternative is essentially a “no change” option from the legacy AF processes. It sees the introduction of Task Force CONOPS as a useful qualitative guide for planning and investment prioritization, much like doctrine guides strategy, but sees the current MAJCOM planning and programming processes and associated HQ USAF panel structure keeping the vast majority of power in the corporate framework. Programming is still done at the margins. Fixed budget bogeys are still assigned to MAJCOMs, and most tradeoffs are made at the MAJCOM level. Since MAJCOMs are also responsible for updating the Task Force CONOPS, they are expected to factor the CONOPS into their POM submissions, but are not process constrained to do so. Task Force Champions are advisors and may provide tie-breaking votes on some key issues at the panel or AF Group level, or recommend offsets. The CRRA process continues as the AF mechanism for conducting broad capability-based portfolio reviews. However, these may evolve toward a breakout of functional areas aligned more closely with panels than with Task Forces (or a hybrid alignment) to provide more direct coverage of functional areas like space, information ops, and command and control.

Acquisition and requirements decision-makers may seek Task Force Champion advice. For instance, the Task Force Champions may sit on the Air Force Requirements for Operational Capabilities Council (AFROCC). The Air Force continues to implement “Agile Acquisition” and “Enterprise Management” activities to improve acquisition practices, but otherwise follows



whatever pace DoD sets in implementing new acquisition and requirements policy. There is no new formal coupling with PPBS processes.

Centralized Air Force architecture management remains focused on the information technology aspects. Some, but not all, MAJCOMs begin to speak in terms of mission architectures, but as informal extensions or “views” of the MAJCOM strategic plans. If DoD insists on strict compliance with new directives on mission area integrated architectures and capability assessments, any required adjustments are delegated to the MAJCOM level—and handled via tweaks to the integrated planning processes there, or perhaps just to the lexicon (mission area analysis, needs analysis, solutions analysis, integrated investment analysis).

### **Alternative 2: Task Force Driven “As-Is-Becoming” Process**

This alternative sees a continued shift in emphasis toward Task Force CONOPS, but with authority moving away from the MAJCOM- and panel-centric corporate structure toward Task Force entities. Champions assume at least an equal role with functional area programmers in setting funding priorities. The two viewpoints maintain a constructive friction. Though the MAJCOMs and panels still receive initial budget bogeys and do most of the heavy lifting in building the POM, a large trade space is identified both “above and below the funding line.” Within that trade space, the Task Force Champions “have the money” and set the priorities based on capability needs. It is up to panels, MAJCOMs and functional representatives to lobby them to adjust the “rack and stack” around the cutoff line. The Task Force Champions and panel chairs become co-advocates for POM segments as they progress (with their associated trade space) through higher-level corporate reviews. Depending on how well the MAJCOMs adapt to this vector, the degree of change to MAJCOM influence could be very little, or “moderate.” Ideally, MAJCOM updates to Task Force CONOPS would be integrated into the initial step(s) of

their integrated planning process, leading to CONOPS-consistent POM recommendations—and, more thorough CONOPS.

The CRRA process accelerates and becomes a more important interface between resource allocation and informed acquisition decision-making. The CRRA reviews and PPBS trade space rankings use a “common scorecard” to prioritize programs, though it may be a subjective assessment. In other words, the CRRA output becomes a living document that is updated periodically and allows the PPBS rankings to be done more routinely. Over time, the CRRA may even reshape the budget distribution to MAJCOMs based on persistent CONOPS-driven priorities. Because of their key role in guiding the CRRA and trade space decisions, the Task Force CONOPS are driven to be more detailed and complete across missions—possibly by adding one or two new Task Forces. As in Alternative 1, acquisition management, requirements generation and PPBS are not formally coupled, but Task Force Champions may advise acquisition decision-makers and the AFROCC, and attend DoD’s envisioned “integrated decision meetings” for combined requirements/acquisition milestones. The higher-fidelity Task Force CONOPS provide a basis for requirements consistency checks at these reviews.

Emphasis on architectures expands slightly from Alternative 1. Both MAJCOMs and Task Force Champions may speak informally about architectures as “views” of their strategic plans and CRRA baselines, respectively. However, like today, the MAJCOMs and Task Forces will focus more on the “prioritized lists” in the programming domain than on architecture views and the longer-range planning domain. Compliance with DoD directives will again be handled mainly by mapping the AF lexicon for the CRRA and integrated planning process onto whatever structure DoD imposes for mission area architectures and assessments.

### **Alternative 3: Enhanced Operational Description: CONOPS Flow down**

This option takes Alternative 2 a step further by forcing a disciplined flow down of the high-level Task Force CONOPS into subordinate-level documents; for instance, using the methodology proposed by Kent and Ochmanek to develop a hierarchy of CONOPS, concepts of employment (CONEMP), and concepts of execution (CONEX). A CONEMP is a concept to achieve a particular operational objective, while a CONEX describes an end-to-end concept for accomplishing a particular operational task.<sup>1</sup> These CONEMPs and CONEXs become cornerstones of the Task Force Champion's and lead MAJCOM's analysis and prioritization efforts.

Breaking the operational hierarchy down into sub-missions, functions, and specific tasks drives the intellectual content of the Task Force CONOPS toward greater detail and completeness. It forces attention on sequenced tasks and actions that link information sources, action-takers, and controllers. This additional detail adds structure and resolution to CRRAs and PPBS assessments, and may increase the fidelity of the "common scorecard." Task Force Champions become "proponents" for CONEMPs and organize CRRAs by CONEX—examining the capabilities needed to execute each critical task, and the associated risks. This simplifies the link to programs and reduces the amount of ad hoc architecting required to conduct the CRRAs.

This alternative further strengthens the authorities of centralized actors in the corporate processes, since it requires a strong "definer" role—notionally, an Air Staff general who guides and controls the disciplined CONOPS hierarchy.<sup>2</sup> MAJCOMs are assigned to develop specific CONEMPs and CONEXs within the hierarchy. By chairing or co-chairing the AFROCC, the definer approves all MAJCOM-developed products and ensures that system-specific CONOPS and requirements documents are consistent with approved CONEXs. The definer is also

responsible for aligning the Air Force mission hierarchy with Joint Mission Areas and DoD-level strategic priorities. Task Force Champions likely work for the definer. Their roles are comparable to those specified in Alternative 2, but with a focus at the CONEX level in the CRRA and in providing acquisition decision advice. MAJCOMs are likewise encouraged to organize their planning framework and “package” their POM recommendations in terms of the CONEX structure—not necessarily an easy task. Though acquisition, requirements, and PPBS decisions are not formally coupled, the CONEXs and CRRA provide unifying guidance to all.

The Air Force regards the CONOPS hierarchy as a sufficiently good approximation to an operational architecture. It again uses certain architectural “views” informally to assist in describing CONEXs, ensuring completeness of the hierarchy, and demonstrating coarse alignment with DoD mission area integrated architectures. In resisting the development of formal architectures, the Air Force accepts limitations in its ability to assess interdependencies.

#### **Alternative 4: Enhanced Architecture and Integration Focus: Task Force Architecture**

This option begins somewhere on the spectrum between Alternatives 1 and 2, and expands the content of each Task Force CONOPS into a more rigorous description in terms of operational and systems architectures. Task Force missions are broken out into one or more “capability packages,” and each capability package is described by a CONOPS *and* a system-of-systems architecture that follows the DoD Architecture Framework.<sup>3</sup> This alternative uses the Navy approach to “mission capability packages,” and Carlock and Fenton’s construct for “system-of-systems enterprise systems engineering” (see Appendix A). The Task Force Champion thus becomes the Task Force architect, or works in close coordination with a designated Task Force architect. However, the champion concept will likely be expanded to encompass a range of architects—some who “own” AF Task Forces, others who are attached to

AF-led functional mission areas (like space or information operations, including the National Security Space Architect), and still others who serve as liaisons to particular DoD-level system-of-system architectures or enterprises such as National Missile Defense, or Theater Air and Missile Defense. CRRA and PPBS assessments are organized by these broadened architecture categories, which provide more complete coverage of capabilities as well as a formal means to show interdependencies (at least partially) and to work integration and interoperability issues. The “common scorecard” used for assessments reflects interdependency factors and gains some objective fidelity.

To provide centralized control over this family of architectures, a “mission architect” function is established on the Air Staff. The architect is responsible for overall definition and configuration control of mission area architectures and the hierarchy of capability packages. The role parallels the “definer” role in Alternative 3, only using architectures rather than CONEXs as the unifying constructs. The mission architect aligns Air Force architectures with Joint Mission Areas, Joint Operational Architecture, and joint “mission area integrated architectures” as required.<sup>4</sup> Task Force Champion/Architects report to the central architect, who also assigns responsibility to MAJCOMs or staff elements to develop details of mission area architectures, roadmaps, and capability packages—and approves the products. MAJCOM mission area plans evolve to adopt the structure and lexicon of architectures: operational views, system views, etc.

The role for a senior operator to serve as CONOPS “definer” could still be present, but with less integration and control responsibility than in Alternative 3. The definer would approve CONOPS and requirements documents through the AFROCC, but overall mission definition and integration are overseen by the mission architect. Note that this option could encompass

Alternative 3 once CONOPS and operational architectures are fleshed out to a level of depth to constitute a “complete” hierarchy.

Task Force Champion/Architects provide more sophisticated advice to decision-makers on funding priorities, requirements, and acquisition programs—reviewing all for consistency not just with the guiding CONOPS, but also with the approved, elaborating architecture description(s). Their wide purview is offset somewhat by limiting their authorities mainly to review and assessment roles vice execution roles. Thus, the current panel and MAJCOM roles are largely preserved in the PPBS process to maintain a balance of power, and to protect certain niche capabilities that do not fit neatly into architectures. However, panels continue their shift toward capabilities-based thinking by becoming conversant in the architectural lexicon.

Additionally, the mission architect and Task Force Champion/Architects coordinate with joint interoperability processes and advocate for “advanced” integration initiatives such as data fusion and machine-to-machine digital integration. They use mission-focused architectures as integration tools, coordinating with AFMC “enterprise managers” as required. Responsibility for information technology and technical architectures remains with the Air Force CIO. Current “architecture councils” might be retained, but those with a mission focus would be restructured to align with Task Force Champion/Architects reporting to the AF mission architect.<sup>5</sup>

### **Alternative 5: Enhanced Analytical Rigor: Scoring Models**

This option again begins somewhere along the spectrum between Alternatives 1 and 2, but the focus is squarely on improved decision support for PPBS processes. It seeks to enhance the “objectivity” of assessment and prioritization methods by introducing a structured scoring model (or value model) to score and rank candidate projects based on appropriate evaluation criteria. These could include military value (of particular projects against specific Task Force

CONOPS elements), cost, and technical maturity. The alternative also seeks to shift the current practice of making decisions “on the margin” more toward an industry-standard approach of reviewing the entire portfolio in every review cycle—at least annually, and possibly more often than that. One or more analytically disciplined decision-support tools would be used to score all projects—though the scoring will likely include a healthy dose of judgment and subjective factors as in the current PPBS processes.

This alternative requires a centralized “chief assessor” function. This senior officer or executive is responsible for establishing “common” scoring criteria for assessments, and defines and controls the approved scoring methodology. The office works with Air Force Studies and Analysis, the Office of Aerospace Studies, MAJCOMs, and other “expert” resources, and also coordinates with OSD PA&E and Joint Staff analysts on joint priorities and assessment criteria. The chief assessor provides guidance to MAJCOMs, Task Force (CRRA) assessment teams, and other AF assessments on criteria and methods that should be used in their internal scoring processes.

After incorporating these guidelines into their integrated planning processes and tools, the MAJCOMs still build the bulk of the POM—and are now encouraged to score baseline programs in addition to the initiatives and disconnects. When MAJCOM POM submittals are integrated at the Air Staff level, panels and Task Force Champions still work together to identify trade space, as in Alternatives 1 and 2. However, the scoring model is re-applied to make the analysis of trade space decisions more objective. Some re-scoring of the “borderline” projects may be done (or additional criteria applied) to account for the broader AF-wide perspective, and to ensure fair integration across MAJCOMs.<sup>6</sup>

As in Alternative 2, assessment outputs ideally become living documents that can be updated frequently for use in CRRAs or in different stages of the PPBS. However, the “prioritized lists” now include the score (or scores) for each project or program, which become a routine dimension in the corporate thought processes. Acquisition and requirements decision-makers tend to ask similar questions: what is the typical score for this type of system or capability? Task Force Champions play an advisory role to all decision processes, similar to Alternative 1. They lead CRRAs, participate actively in the scoring assessments, provide feedback and advice to the chief assessor, and provide other subjective judgments and recommendations to complement the scoring data.

The approach to architectures in this alternative is similar to those in Alternatives 1 and 2. Since the focus is on scored and prioritized “lists of programs,” informal architectural “views” are only used where they help to describe program portfolios.<sup>7</sup> Otherwise, the Air Force adapts the CRRA and MAJCOM planning processes to comply with any DoD-directed standards for mission area architectures and assessments.

#### **Alternative 6: Enhanced Program Scrutiny: Integrated Portfolio Management**

This option seeks to increase the quality of information available about both the health and relevance of specific projects and programs as they come up for either resource decisions *or* acquisition milestone decisions. It involves a fundamental re-look at the segregation between the PPBS and acquisition management processes, proposing to integrate these decision processes following an industry best practice model of portfolio management. Acquisition milestone decisions will include a realistic assessment of the ranking of the program within the overall resource priorities list (in addition to traditional looks at program cost, risk, acquisition strategy, military utility, etc.). Thus, the likelihood of killing low-ranked programs at these reviews will



increase. Likewise, corporate PPBS decision-making will be centered on programs at or near Milestone B, where sufficient details should be available—and are demanded—to make informed commitments of resources.<sup>8</sup>

This integrated strategy entails a more forgiving, risk-taking approach to funding technology and pre-Milestone B projects. In terms of the “strategic buckets” concept for controlling overall investment priorities—another “best practice” theme of this alternative—funding is increased in the science and technology bucket while formal project scrutiny is minimized during concept exploration. A more agile “concept PEM” role is defined, able to flexibly manage funds within concept portfolios, and less constrained by formal acquisition reporting. The payback comes with a corresponding increase in scrutiny at Milestone B and in subsequent resource allocation cycles. Program information (e.g., the next-generation RAPIDS charts) is expected to be of consistent high quality for PPBS deliberations.

Similar to Alternative 5, all projects near or beyond Milestone B are fully and regularly reviewed. PPBS and CRRAs tend toward being seamless and indistinguishable, using common scoring methods. The roles of panels and Task Force Champions in building assessments and trade space could be anywhere on the Alternative 1-2 continuum. It may be simpler to initially emphasize the panel structure, since resource “buckets” become less intuitive under the Task Force organization. An evolution from one to the other could certainly occur. MAJCOMs are constrained somewhat by firmer strategic bucket guidance. Though they build their own POMs, they are aware that their “borderline” programs will be closely scrutinized in both PPBS trade space and at their acquisition milestones.

The central organizing authority in this alternative is probably at the level of the chief of staff and secretary of the Air Force. A unifying context for decision support is still important—it

is provided by the strategic buckets approved by the chief and secretary (and probably recommended by the AF programmer), and by the scoring model(s) used to prioritize within those buckets (likely managed by one or more chief assessors).<sup>9</sup> However, the emphasis is on the integrated decision-making. The chief and secretary make final decisions on the POM, and review and approve CRRRA results. This alternative sees the secretary making key acquisition decisions as well. New criteria are established for the delegation of acquisition milestone decision authority. While many decisions are still delegated to the Service Acquisition Executive, certain “funding driver” decisions (e.g., for “trade space” programs at Milestone B) require the secretary’s approval. A “decision manager” function (drawn from current programming and acquisition staffs) should be set up to plan and support decision meetings.

This approach is less concerned with CONOPS and architectures than other alternatives. It relies on senior leaders being able to look across the entire portfolio (or at least across a wide trade space), and make sound strategic decisions, given a modest amount of supporting scoring analysis.<sup>10</sup> This mirrors business environments where products stand more or less on their own. Interdependencies and systems-of-systems issues get only limited, subjective attention.

#### **Alternative 7: Enhanced Concept Innovation: Control Without Control**

The last option serves as a hedge against excessively prescriptive “top-down” strategic guidance and centralized control within the portfolio of investments, though it shares certain features of Alternatives 5 and 6 in leveraging business best practices. It could begin anywhere along the Alternative 1-2 continuum. It uses Task Force CONOPS as a nominal reference frame for gauging the “importance” of capabilities, and the current MAJCOM-led strategic planning process to establish a nominal roadmap in Task Force and functional areas. However, it intentionally funds a broader set of technologies and concept explorations than those required for

“the plan.” Since a rigid plan is almost sure to be wrong after the 15-plus years required to develop and field major systems, this approach funds the nominal plan but also various paths to react to adversary “anti-plans,” operating on the edge of order and chaos.<sup>11</sup>

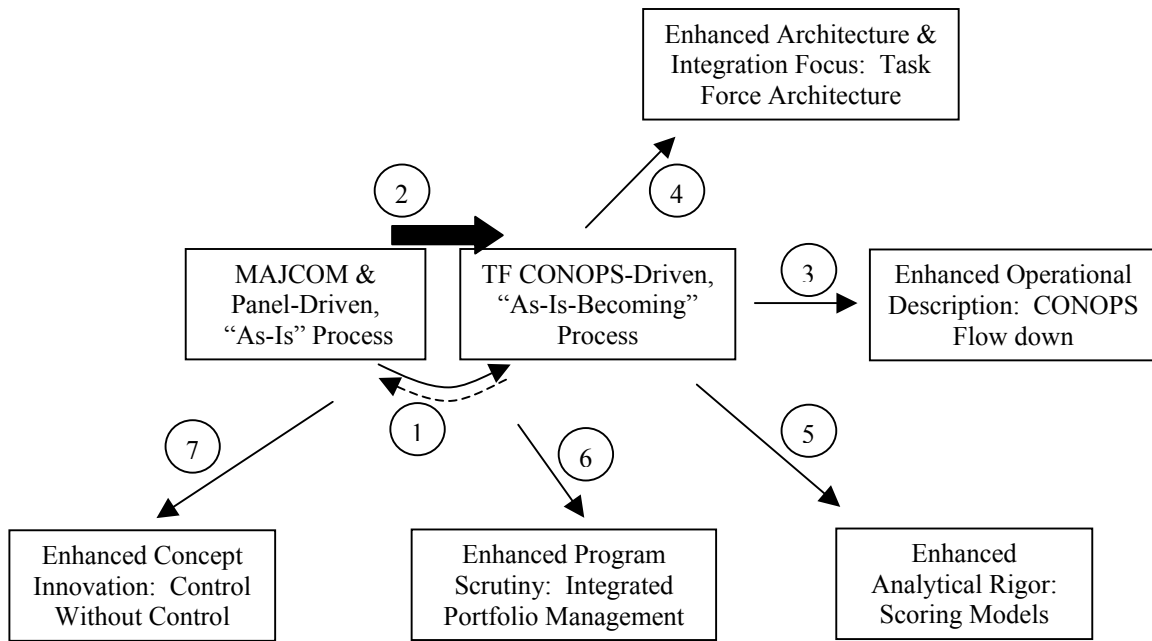
Leveraging ideas from complexity “theory,” the theme of this alternative is to impose only broad controls and allow the implementing agents to freely interact and adapt to them. Human creativity and self-organizing forces are enabled to the maximum extent possible.<sup>12</sup> Air Force leaders provide loose centralized “control” in the form of broad planning guidance, to establish strategic buckets and certain interoperability rules. Programming guidance is de-emphasized. Broad threat/scenario “design space” for concepts and capabilities is incorporated in the planning guidelines, as advocated by Davis and other RAND approaches (see Appendix A). Given those broad guidelines, creative adaptation is encouraged within MAJCOMs, product centers, laboratories, and Task Forces, and supported with real funding. Like Alternative 6, this approach requires a larger science and technology strategic bucket than is funded today—perhaps significantly larger. It likewise employs an agile “concept PEM” role to enable flexible movement of money to the “best ideas” within the broad buckets. MAJCOMs are specifically pushed to get away from the bias to fund near-term crises. More risks are encouraged, more failures are allowed, but more innovation and adaptability in capabilities should result. The theme follows Waldrop’s framework for “control without control” that is included in Appendix A.

This alternative is dominated by the emphasis on innovation, technology, and alternative futures. Corporate process details are less important. Thus, the alternative could eventually resemble any of Alternatives 1-6 in its process implementation. At a minimum, the CRRA should continue as a mechanism to indicate priorities for resource decisions—with extra

emphasis on innovative concepts and technologies to fill future capability gaps. The approach could be consistent with Alternatives 3 and 4, if architectural guidelines are kept very broad (ensuring interoperability from an “open systems” perspective), or CONOPS flow downs remain flexible and open to technology-driven changes. Also, it would benefit from Alternative 6’s more dynamic and integrated decision framework among the acquisition and PPBS processes, and from Alternative 5’s analytical framework for prioritization (both are best practices for new product portfolio management). These features would make it easier to start a range of new projects, focus assessments at the right go/kill gates, and kill them if they prove unnecessary (or at least put them on the shelf until threat and circumstances justify a revisit).

### **Perspectives of the Alternatives**

The seven alternatives address the range of issues with different themes or “focus areas” as indicated in Figure 7 and in the first column of Table 2. Each approach would involve many players, but the key actors and “living documents” are shown in the next two columns of Table 2 to better indicate the nature and emphasis of the “vector.” The alternatives are designed to leverage ideas from the “comprehensive frameworks” described in Appendix A, as shown in the last column of Table 2.



**Figure 7. Alternative Vectors**

**Table 2. Summary of Alternatives**

Characteristics → Alternatives ↓	Emphasis of “Vector”	Key Actor(s)	Key Living Document	Process, Framework, or Theoretical Model Basis
1. As-Is	MAJCOM & Panel-Driven, Status Quo	MAJCOMs, Panels, AF Group	MAJCOM Strategic Plans	MAJCOM Integ Planning Process, Strategy-to-Task
2. Task Force Focus	Task Force CONOPS- & CRRA-Driven	Task Force Champions	CRRA Output	CSAF Vision, AF Transformation Plan, New AFI?
3. CONOPS Flow down	Enhanced Operational Description	CONOPS Definer & TF Proponents	CONOPS Hierarchy	Kent & Ochmanek Framework, AFPD 10-28
4. Task Force Architecture	Enhanced Architecture/ Integration Focus	Mission Architect & TF Champ/Architect	Capability Package Architecture	Joint Integ Arch, Navy MCP, Carlock Sys-of-Sys ESE
5. Scoring Model	Enhanced Analytical Rigor	Chief Assessor	Common Scorecard	Value Models, RAND DynaRank
6. Integrated Portfolio Management	Enhanced, Integrated Program Scrutiny	Decision Makers & Managers	Portfolio Rack & Stack	Cooper et al. Portfolio Management
7. Control Without Control	Innovative Range of Concepts	Concept Generators	Broad Planning Guidance	Waldrop Complexity “Theory,” Davis’ Mission/System

Another way to look at the alternative vectors is to note their relative emphases on resolving the overarching issues and challenges identified with the current approaches for translating strategy into programs. Table 3 shows the extent to which the different vectors attempt to address the driving issues identified earlier. The senior leadership view on which problems are most pressing might help determine which vector is best to align against for the overall course of change.

**Table 3. Coverage of Driving Issues and Challenges**

(X = primary focus area, S = secondary effect)

Driving Issues →  Alternatives ↓	Joint Priorities, Missions, Concepts	CONOPS Quality & Completeness	Common Lexicon	Architecture Roles & Accountability	Process Linkages, Common Scorecard	Current Stovepipes (Acq, Reqts, Plans)	Corporate Alignment	Buy-in at All Levels of Stakeholders	Overall Portfolio Balance /Integration	Innovation, Flexibility	Analytical Rigor, Data Quality	AF vs. OSD/Joint Assessments	Cost-Effective Business Practice
1. As-Is	S	S						X	X	S		S	
2. TA SK FO RC E FO CU S			X		S	X	S		S		S		S
3. CONOPS Flow down	S	X	X	S	S	S	X			S	S	S	S
4. Task Force Architecture	S	S	S	X	S	S	X		S		S	X	S
5. Scoring Model	X	S	S		X	S		S	S		X	S	S
6. Integrated Portfolio			S		X	X	S	S	X	S	X		X
7. Control w/o Control	S	X				S	S	X	S	X			S

#### Notes

<sup>1</sup> For details see Appendix A and AFRD 10-28, 1-3.

<sup>2</sup> This expands a role defined by Kent and Ochmanek, 11-13.

<sup>3</sup> A capability package would also include a command approach, organizational structure, processes and appropriately skilled personnel.

<sup>4</sup> Establishing consistent architectural underpinnings across the entire Air Force mission portfolio will already be a mammoth challenge; joint compatibility adds another layer of difficulty.

<sup>5</sup> Lt Gen Woodward's model of an "architecture integrated product team (IPT)" for each Task Force may be a good one, provided that it does not result in too many cross-wired constructs—panels, Task Forces, architecture councils, and architecture IPTs. See Lt Gen Woodward, 7.

## Notes

<sup>6</sup> In other words, it may be necessary to provide an independent calibration of MAJCOM scores before projects and scores are integrated across MAJCOMs. In the proposed approach, it is not necessary to normalize scores across the totality of all AF projects. Normalization is only done within the trade spaces, which could still involve many projects and require a time-intensive scoring review. This seems to be the only way to make a scoring method viable—a mix of decentralized and centralized scoring under reasonably common standards.

<sup>7</sup> However, the scoring approach will benefit from additional detail in breaking missions and challenges down into their component parts—sub-missions, functions, tasks, and required capabilities that can be used to build a “value hierarchy” of criteria, sub-criteria, and weights. Thus, Alternative 5 could become an enhanced version of either Alternative 3 or 4 if a number of ambitious changes occur. The value models would be built using the mission structure and hierarchy from the CONOPS flow down and/or architecture descriptions.

<sup>8</sup> Arguably this is fairly consistent with today’s acquisition philosophy—acquisition programs must “show” affordability, and attain “full funding” by Milestone B—but the “norms” are not enforced with much discipline, and the PPBS process does not enforce corresponding discipline in demanding a consistent quality of information about projects under review.

<sup>9</sup> Since this approach is synergistic with the availability of a rigorous scoring model, it can be viewed as an aggressive expansion of Alternative 5. Conversely, the higher quality of program data demanded in this alternative would also benefit the scoring in Alternative 5. So either alternative could evolve to assimilate the other. The difference is what has first priority—the scoring model, or the integrated decision process?

<sup>10</sup> Much like the legacy Air Force approach to PPBS decision-making, but with improvements to the poor decision support tools and data currently available to senior leaders; see Greiner et al., 126-134.

<sup>11</sup> Westphal et al., 30-33.

<sup>12</sup> According to Waldrop, “complexity theory” is less a formal theory than a set of metaphors applicable among decentralized systems where many “agents” constantly interact and adapt in a massively parallel structure. See M. Mitchell Waldrop, “Control Without Control: From Complexity to the Management of Innovation,” seminar presentation for joint RAND and Woodrow Wilson Center project on Complexity and Public Policy (2002), 7-14, on-line, Internet, 19 December 2002, available from <http://www.complexityandpolicy.org/dial.htm>.



## **Part 7**

### **Assessment and Recommendations**

The merits of the alternative vectors can now be evaluated against the criteria compiled in Table 1. Each alternative is examined carefully to estimate how well its implementation would reflect the desired attributes included in each rolled-up evaluation criterion. For example, the attribute of “coherence with joint and DoD review/assessment processes” might be satisfied by an alternative completely, partially, or not at all. Summing up the attribute-level merits over the set of attributes results in an aggregate rating against the criterion. The results of those aggregate assessments are summarized in Table 4. An overall rating for each alternative is given in the last column as a rollup across all criteria.<sup>1</sup> The subjective assessment method is admittedly imperfect—others may interpret and score the alternatives differently—but it does consider “coverage” of attributes within each criterion, and the likely quality and effectiveness of the coverage (i.e., will the features make a difference even if implemented?).

The assessment in Table 4 does not point to a clear, preferred alternative among the seven candidates. However, it does indicate that significant improvements over the “baseline” are possible. First, the emerging Task Force focus (Alternative 2) already provides modest advantages over the legacy approach (Alternative 1) across most criteria. Alternative 2 offers a unifying capabilities-based strategic focus and begins to stimulate integration (both process and mission) and innovation, at the price of slightly increased complexity of implementation.

Second, the five “enhancement” vectors each provide a further overall improvement, with significant benefits for particular criteria. For instance, Alternatives 3 and (especially) 4 are strong in mission integration; Alternatives 5 and 6 provide the best process integration and efficiency; and Alternative 7 best enables strategic innovation. Meanwhile, some of the highest-scoring alternatives face significant implementation challenges. Alternatives 4 and 5 would be most difficult to execute, in terms of cumbersome models, complex processes, and required skills and training. Alternatives 5 and 6 would have policy obstacles and organizational flaws to overcome. Interestingly, two of the overall “best performers,” Alternatives 4 and 7, score very differently on most criteria. The first is the most structured and controlled approach while the second is a “control without control” option—yielding about the same net benefit.

**Table 4. Assessment of Alternatives**

(E = excellent, G = good, S = satisfactory/fair, P = poor)

Evaluation Criteria →  Alternatives ↓	Process Horizontal Integration	Process Vertical Integration	Mission Horizontal Integration	Mission Vertical Integration	Priorities Strategic & Focus	& Innovation Flexibility	Efficiency	Organizational Viability	Process Suitability		Overall Assessment
1. As-Is	P	S	P+	S-	S-	S-	S-	G-	G-		S-
2. Task Force Focus	S	S	S-	S	S+	S+	S+	S+	S+		S
3. CONOPS Flow down	S+	S+	G-	G-	G	S+	S+	S+	S+		S+
4. Task Force Architecture	G-	S+	E-	E-	G-	S+	G-	S+	P+		G-
5. Scoring Model	G+	G+	S	S	G+	S	G	S-	S-		S+
6. Integrated Portfolio	G-	G+	S+	S+	G-	G	E-	S-	S+		G-
7. Control w/o Control	S	G	S-	S+	G	E	S	S+	G-		G-
Composite (Threshold)	E-	G+	G+	E-	E-	G	E-	S+	S		G+
Composite (Objective)	E	E-	E-	E	E	E-	E	G+	S+		E-

**A Composite Alternative**

Alternatives 3-7 each offer a number of appealing features; any of these alternatives could be a good course of action by itself. However, it seems desirable to bring as many of their candidate enhancements together as possible in the final recommendations—provided that a reasonable overall approach remains intact. The resulting “composite alternative” would leverage the aggregate benefits of the best alternative vectors. The alternatives assessment

highlighted the following features as the key “nuggets” to be included, if possible, in a composite alternative:

- **A “definer” function** (from Alt 3-4)
  - To define a CONOPS hierarchy based on critical mission challenges
  - To serve as operational requirements authority
  - To initially produce an informal hierarchy and map AF concepts to joint operational concepts, with a full set of CONEXs (Alt 3) as a long-term objective
- **A “mission architect” function** (from Alt 4)
  - To define, manage, and ensure joint integration of a hierarchy of mission area architectures with associated roadmaps and portfolios
  - To interface with AF technical architects and “warfighting integrators” as required
  - To ensure that architectures remain broad “open systems” models that allow innovation from the field
- **Task Force Champion/Architects** (from Alt 4)
  - Report to the mission architect (may report to the definer as well, Alt 3)
  - Responsible for oversight of Task Force CONOPS or CONEMP, system-of-systems architecture descriptions, capability roadmap, and project/program “rack and stack” list for the Task Force area and any subordinate capability packages
  - Develop architectures beginning with a few basic views, adding formality and achieving full compliance with the DoD Architecture Framework as a long-term objective
  - Serve as “single architect” for a Task Force, though work is tasked to MAJCOMs or other staff elements
  - Advise AFROCC, PPBS trade space deliberations, and acquisition boards
- **A regular and continuous set of CRRA-like reviews** (from Alt 2-6)
  - Led by Task Force Champion/Architects
  - Update the rankings within program portfolios
  - Refine the “connective tissue” among the CONOPS, architectures, capability roadmaps, and specific programs that supports the assessments
- **A “common scorecard” assessment approach** (from Alt 2-6)
  - Managed by a **“chief assessor” function** and assessment teams aligned with Task Force areas
  - Initially a subjective scoring tool applied mostly within Task Force areas (e.g., a program gets a score from each Task Force, so it eventually has a “score vector” across Task Forces)
  - Assessor ensures reasonable standardization of scorecard criteria and fosters alignment with joint assessment criteria<sup>2</sup>
  - Broad application of the scorecard to cross-cut trade space decisions and realize full-up value model (Alt 5) as long-term objectives

- **A centralized “decision manager” function** (from Alt 6)
  - To plan and orchestrate AF senior leader decision meetings to validate CRRA results, finalize PPBS rankings, make key acquisition decisions, etc.
  - To ensure decisions are supported by common CRRA scorecard results and high quality program data, shared among MAJCOMs and HQ staffs
  - To push to make “score vectors” and higher-quality decision data part of the culture, focusing on Milestone B level maturity projects
  - To include *all* projects in integrated decision reviews as a long-term objective, as tools and procedures mature
  
- **A “chief strategist” function** (from Alt 7)
  - To assist AF senior leaders in defining broad strategic guidance, strategic buckets for investment, and “design space” ground rules for concept developers
  - Potentially implemented as a corporate body comprised of the mission architect, definer, programmer, assessor, and other senior officers as appropriate
  
- **An agile “concept sponsorship” function** (from Alt 6-7)
  - Includes **concept PEMs** under a **chief “capability planner”**
  - To flexibly support science and technology investment, concept development efforts and experiments
  - To be aligned with Task Force areas
  - To conduct formal acquisition program oversight (possibly assigned to functional areas) after Milestone B
  
- **A programmer function** (supporting a corporate board structure, from Alt 2-4)
  - To identify fiscal constraints and assist in balancing modernization investments with other resource demands
  - May include the decision manager function
  - Includes functional panel chairs that work closely with Task Force Champion/Architects to define trade space and focus common scorecard assessments against the trade space issues.

This composite alternative can be seen as a hybrid of Alternatives 4 and 6, with the most ambitious parts of those options (involving policy or statutory changes, complex or cumbersome methods, specialized training, etc.) identified as longer-term objectives. It attempts to continue the capabilities-based trends of the Air Force’s Task Force initiatives, while responding to the additional pressures to implement architectures, improve joint interoperability, and pursue more efficient and strategically aligned approaches to resource prioritization, program assessment, and acquisition. The guiding products and structures in the composite framework are intended to be

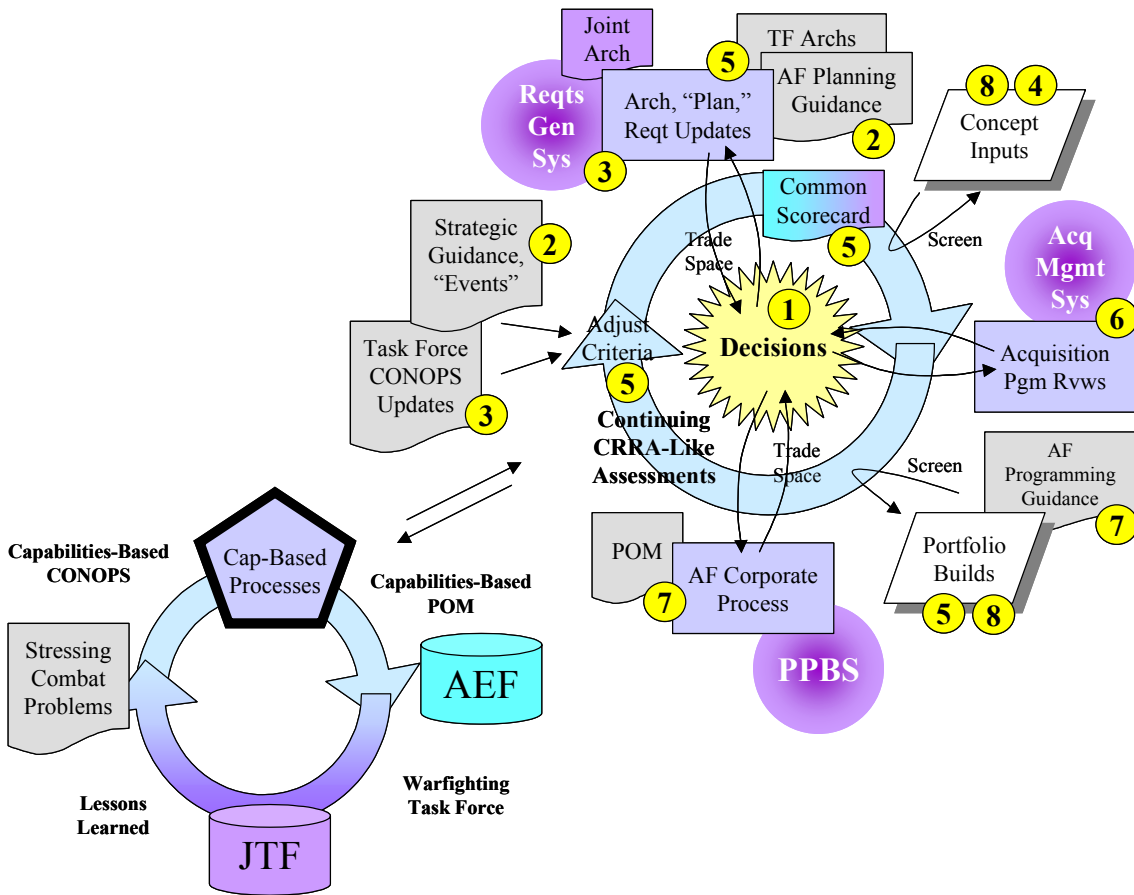
sufficiently broad so as to allow the innovation philosophy and investment strategy of Alternative 7 to be implemented, to the degree it is affordable. The benefits of Alternative 3 are also included to a large extent. However, the value model approach of Alternative 5, which scored well in the assessment, is cast as a long-term objective growing from the “prototype” common scorecard approach.

How does this composite approach stack up against the other alternatives? An answer is provided in the last two rows of Table 4. In fact, two variants of the composite alternative are assessed there: (1) a “composite threshold” that implements those elements believed to be achievable, with concerted effort and dedication, over the next few years; and (2) a “composite objective” that assumes that all of the harder, longer-term objectives called out in the descriptions of key “nuggets” have also been implemented or achieved. As Table 4 shows, the composite threshold rates “very good” overall, well above any of the seven alternative vectors—though it is not better for every criterion. Its biggest drawback, as with its “parent” Alternatives 4 and 6, is in the viability of the organizational and process changes needed to implement it. Making the required number of changes over the next few years will be difficult, even if each is reasonable by itself. The composite threshold is an intermediate, but ambitious waypoint on the hypothetical path toward an “ideal” modernization framework that would “cover all the bases” extremely well.

The composite objective gets “excellent” ratings against all criteria except, again, the ones dealing with implementation viability and suitability. The objective approach would require significant policy changes, more complex and comprehensive tools and methods, and higher levels of personnel skills and expertise. However, its implementation scores do improve slightly over the composite threshold option, even though more complex changes are involved—

partly because more time is allowed to adapt to the changes, and also because the evaluation criteria include attributes such as “balance of power” that benefit from a full-up implementation of the composite features. The composite objective can be viewed as a “best approximation” to an implementation approach meeting the “ideal” scope for a modernization framework outlined in Chapter 5.

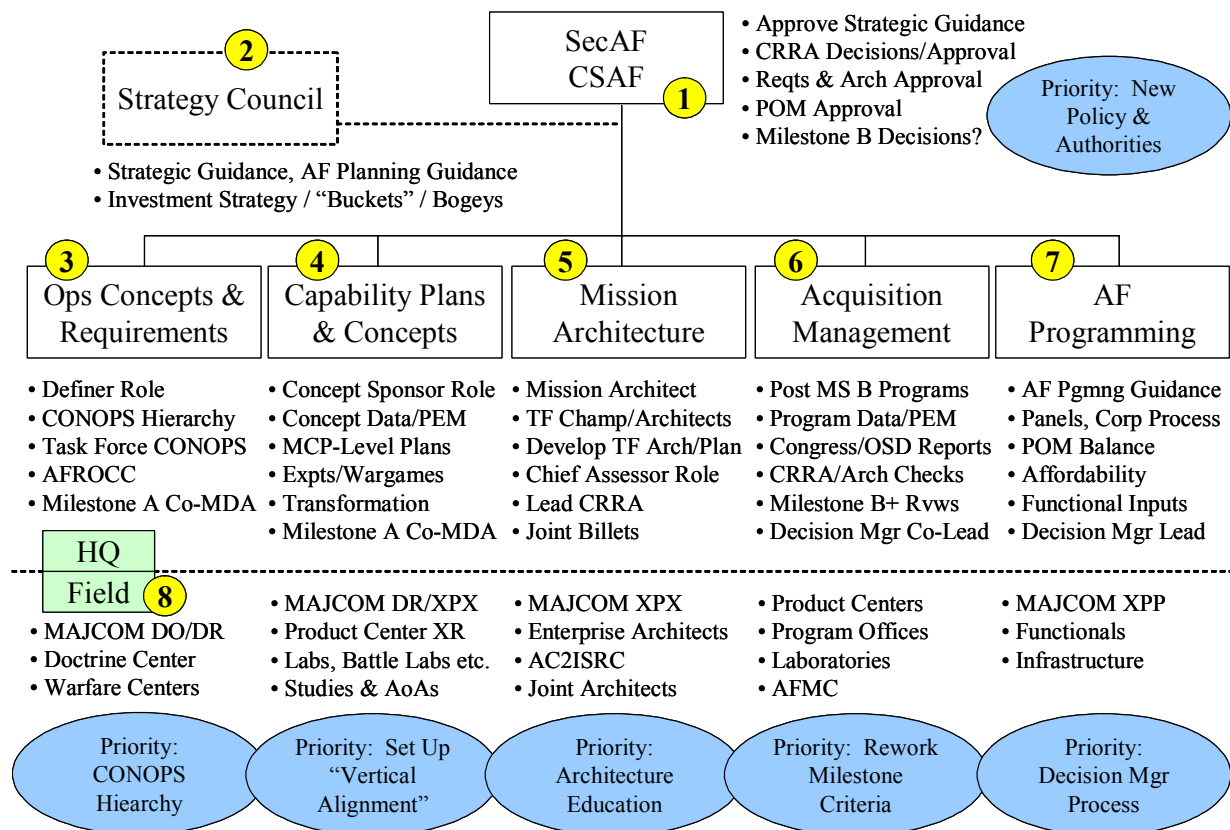
To add some descriptive fidelity to the composite threshold alternative, it can be represented in terms of both a notional meta-process, and a notional organizational structure (Figures 8 and 9). These descriptions help articulate a further “vision” for the recommendations of the paper. The cyclic process in Figure 8 is intended to capture the main themes and the rhythm of employing Task Force CONOPS, architectures, and CRRA-like assessments (with common scorecards) to underpin corporate decision-making. The cycle begins as DoD strategic guidance and Air Force lessons learned from joint operations flow into Task Force CONOPS and architecture updates, as well as into refined CRRA evaluation criteria. These guide the iterative updating of capability plans, requirements, roadmaps, and program portfolios for POM construction. In each iterative step, trade space is identified and subjected to a common CRRA-like assessment—allowing senior leadership to review the “score vectors” and other decision



**Figure 8. Composite Alternative – Process**

data and approve the priorities. Top-down strategy is also translated into broad, architecture-consistent AF planning guidance for concept developers, who can anticipate the merits of concepts from a common scorecard screening. As material concepts aspire to become acquisition programs at Milestone B and beyond, the key milestone and portfolio reviews will again employ the same scorecard and architectural consistency checks to support go/kill decisions and validate program priorities. The pervasive, capability- and architecture-based assessments create a regular rhythm of continuing adjustments that make POM production a more routine and repeatable event.

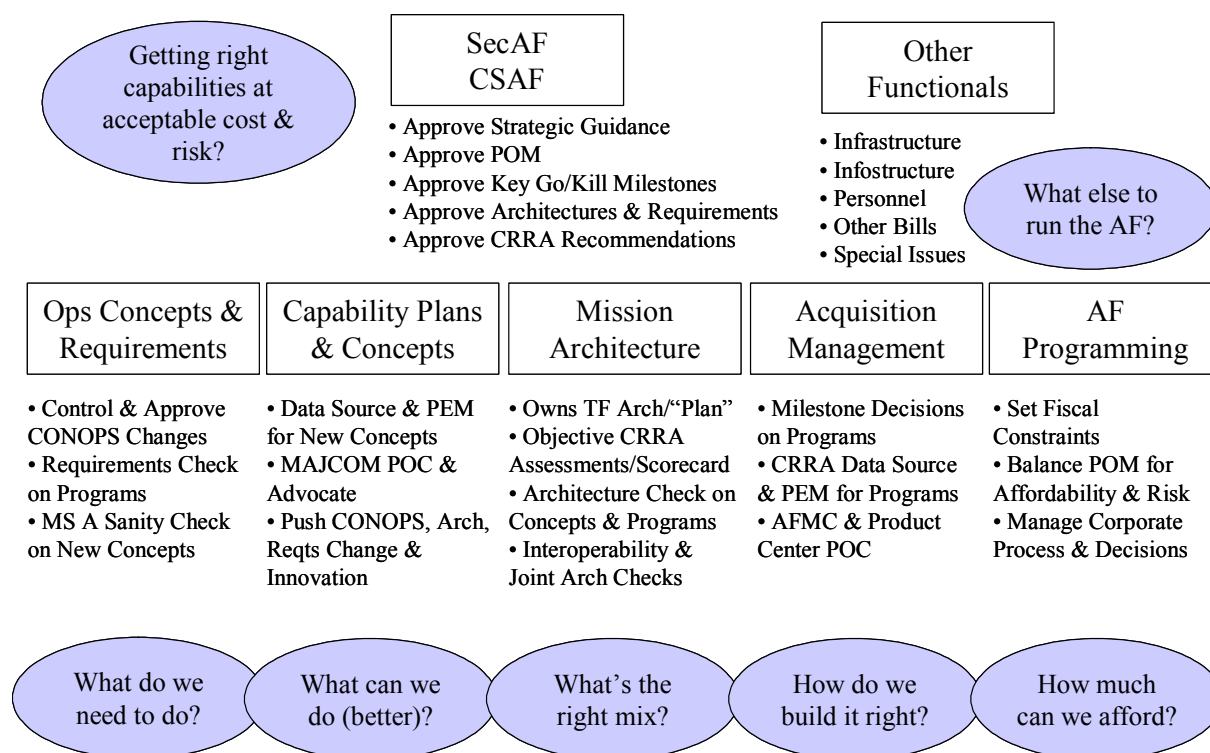




**Figure 9. Composite Alternative – Organization**

Figure 9 shows one possible approach for organizing the key actors and interacting functions within corporate and field organizations, with a Task Force emphasis and appropriate balance of power in shaping decisions, actions, and capabilities.<sup>3</sup> The numbers “1” through “8” in Figures 8 and 9 indicate which actors have the lead roles in the main process steps or products. All of the key elements of the composite approach can reasonably be imagined to co-exist without excessive conflict. To verify this, Figure 10 shows an approximate set of checks and balances that would be designed into this composite organizational approach. Although some changes to current organizational power and influence would occur, most are not drastic. The major exception may be in the centralized strategic planning function. Since this was viewed as lacking corporate power and accountability in the discussion of current stovepipes in Chapter 4,

it does not appear explicitly in Figure 9. The headquarters-level planning functions are segregated from programming and redistributed among the strategy council, mission architect, and capability planner/concept sponsor roles—and to MAJCOM planners.<sup>4</sup>



**Figure 10. Checks and Balances**

## Recommendations

The “composite threshold” alternative becomes the primary reference point to guide recommendations for near-term changes. It assembles best-rated features from the range of alternatives, features that are generally amenable to realistic “small” steps to vector from today’s baseline approach toward an efficient, integrated modernization framework. Over time, that path may carry forward to the “composite objective” level. The following recommendations are

offered as a logical set of actions to implement reasonable near-term changes (though not necessarily easy ones), and to catalyze continued future progress.

Establish a common lexicon. The AF should immediately begin an effort to establish common definitions for all key terms related to Task Forces, CONOPS, architectures, capabilities, and effects. Too many different organizations are working these areas without a common lexicon. A prior CONOPS initiative was hampered by the unclear definitions and context outlined in AFPD 10-28.<sup>5</sup> The common lexicon must strive to be joint-compatible and cannot be too Pentagon-centric—it must be intuitive and useful to operators, developers, and technologists at the MAJCOMs and other AF centers of expertise.

Reduce the “corporate matrix” to two dimensions. The AF should immediately align the breakout of Task Forces, corporate panels, architecture councils, and development organizations into no more than two crosscutting structures. Friction between two dissimilar organizational constructs is healthy to attack seams and stovepipes, but three or more impedes coordination.

Align champions, architects and architectures. The AF should immediately appoint the Task Force Champions as Champion/Architects, and consider elevating these to brigadier general positions (or at least very senior colonels). The Champion/Architects should eventually report to a two- or three-star general (or civilian equivalent) designated as the AF mission architect. The mission architect should ensure alignment among Task Forces, headquarters architecture councils or teams, Air Force Materiel Command enterprise managers, and other AF architecting and system-of-systems engineering functions. Also, within one to two years, the mission architect should produce an approved hierarchy for the “mission area integrated architectures” and “capability packages” under each Task Force, and develop a correlation matrix between the AF and joint mission areas, operational concepts, and architectures

(assuming that stable joint concepts emerge in that time frame). Task Forces should achieve a common “big picture” understanding of *all* elements and linkages in the capabilities-based framework (among CONOPS, architecture, plan/roadmap, assessment criteria, etc.)—with just enough standardization and alignment to ensure coherent teamwork and maximize the returns from human initiative.

Invite joint participation. The AF should seize the initiative by inviting joint participation in CONOPS and architecture development, in the CRRA, and in developing assessment criteria and common scorecards. This could include a modest number of joint billets on Task Force-related teams. The AF would foster joint interoperability and synergy, and also gain the opportunity to tap into sources of considerable architecting expertise. Concurrently, the AF needs to encourage clear joint delegation of responsibility for AF-led CONOPS and architectures, to avoid wasted effort on areas likely to be “taken over” by imminent “born-joint” thrusts. For the near term, joint participation need not extend into PPBS and acquisition management (except for designated joint interest programs)—but this could change depending on DoD policy direction.

Make the architecture focus real. The AF should set a goal to have an interim architecture built for each Task Force mission area or “capability package” during the next year or next CRRA cycle. Architectures must include both operational and systems views (developed together), supported as required by additional detail in the hierarchy of CONOPS. A “prototype” build should only take a few months,<sup>6</sup> and would stimulate the adoption of the right vocabulary (much as the current Task Force efforts have ingrained “capabilities” terminology into corporate discussions). This would be recognized as the first step in a spiral development process to gradually add fidelity to CONOPS, operational architectures, and so forth—ultimately moving

toward compliance with the DoD Architecture Framework. More detail can be added as mission breakouts mature, training and education proceed, and joint architecture approaches are clarified.<sup>7</sup> Task Force Champion/Architects should participate as advisors in acquisition milestone reviews, providing an architectural consistency check on programs and requirements.

Build a common scorecard and decision management policy. Within the next two CRRA cycles, the AF should develop and refine a common capabilities-based assessment “scorecard” to measure merits—to be used in the CRRA; in the foundational development of architectures, requirements and capability roadmaps; in acquisition program reviews; and in PPBS portfolio builds and prioritization processes.<sup>8</sup> A “chief assessor” should be designated to lead this effort, drawing on the range of AF and joint analytical resources. The chief assessor and AF programmer should develop a “next-generation RAPIDS” format for PPBS decision support data based on the common scorecard. Concurrently, the AF should implement a policy to require that decision packages for any centralized review or board be structured in a standardized way, to include the common scorecard assessments. This policy would apply to: resource decisions made by the chief of staff and secretary of the Air Force; subordinate-level decisions in PPBS corporate boards, acquisition boards, and the AFROCC; and to CRRA and roadmap/architecture approvals. The programming and acquisition communities should be tasked to jointly create and staff a “decision manager” organization to manage corporate decision processes from an integrated perspective, including the use of common decision support tools.

Make strategic planning matter. The AF should begin to restructure headquarters-level strategic planning processes and organizations to foster action and accountability. Too much time and effort are spent building “visionary” roadmaps with little connection to programming and technology investment. A chief “capability planner” should be designated (separate from the

AF programmer) to provide focused sponsorship of transformational concepts and capability packages. This two- or three-star general officer or civilian equivalent should share Milestone A decision authority with the CONOPS and requirements “definer.”<sup>9</sup> Current long-range planning “thinkers” and concept PEMs should be brought together under the capability planner, ensuring close ties between strategic plans, “real” concepts that fit into the desired capability packages, and the decision and funding processes to get those new concepts “into the pipeline.” Plans need to remain dynamic and robust, but be developed within an architecture and integration perspective. Thus, concept PEMs and planners should advocate a range of ideas from developers, technologists, experimenters and wargamers to the Task Force Champion/Architects.<sup>10</sup> Finally, the AF should set up some type of “strategy council” to validate annual AF strategic planning and investment strategy guidance (separate from the annual programming guidance). However it is implemented, it should give the chief of staff and secretary of the Air Force balanced advice from the capability planner, mission architect, definer, programmer, and other senior leaders to shape a “control without control” strategy.<sup>11</sup>

Develop the skills and expertise. The AF must expand and accelerate education and training (and hire staff as appropriate) in the skills and disciplines needed for architecting, system engineering, portfolio management, and analysis. The secretary of the Air Force initiative to set up a center of excellence for systems engineering at the Air Force Institute of Technology is a positive step, but the AF lags behind the Navy and other government agencies in sending its workforce to architecture education and training. While long-term changes appear to be on course, a near-term stimulus could be achieved (following the Navy example) by sending “change agents” to an intensive training program for building mission area architectures.<sup>12</sup> This would include Task Force Champion/Architects and some of their key team members, including

MAJCOM leads. Also, DoD should emphasize architectures in the Defense Systems Management College curriculum—broadening the traditionally system-centric program management course that all acquisition professionals must attend. Other education and training opportunities should be pursued beyond the architecting thrust. For instance, commercial courses in portfolio management and new product development are available to prospective decision managers and capability planners.<sup>13</sup> Strategic analysts, planners and “common scorecard” designers will need to get smart on techniques for decision-making and value modeling under conditions of complexity and deep uncertainty.

Communicate the expanded Task Force vision. Finally, and perhaps most important, the AF should not implement these (or similar) recommendations as a disjointed set of individual actions. Air Force leadership must synthesize and then over-communicate the “big picture” of the totality of envisioned changes, to clearly set the tone for the importance of new roles, functions, processes, and organizations. “Chief’s Sight Pictures,” CORONA reports, and other media interviews would be good vehicles to announce the changes and explain the need—following the model of the current information campaign for the Task Force CONOPS and CRRA. Realistically, a special study group should be asked to investigate options and recommend specific implementation details before proceeding with the “kickoff.” Given the complexity of the problem, care must be taken to “get the details right” to help minimize the inevitable backlash of confusion, skepticism, and resistance.

## Notes

<sup>1</sup> The rating scale from P (poor) to E (excellent) was chosen partly because it translates to a 1-10 numerical scale, where P=1, P+ = 2, S- = 3, ..., E- = 9, E=10. Thus, an alternative that partially met all attributes would get approximately 50% credit, or an “S+” score; one that fully met two attributes and partially met the remaining three would get roughly 70% credit, or a “G” score; and so forth. This scale also makes it easy to compute the rolled-up overall scores. All criteria are weighted equally, though different weights could be applied, if desired.

<sup>2</sup> Potentially enabled via joint billets in the Task Force architecture or assessment teams.

<sup>3</sup> Figures 9 and 10 are not intended to suggest details at the level of new operating instructions or organizational charts. There are clearly many options for attaching new functions to existing organizations or

## Notes

processes, and many others that would create new structures. Thus, the two figures are generic idealizations that offer one way to envision the composite approach. Also, the suggested organizational scheme impacts just a small subset of headquarters organizations—those most responsible for modernization activities.

<sup>4</sup> Other current headquarters organizations that could notionally be impacted include the deputy chief of staff for Warfighting Integration (AF/XI), which could see some of its functions shifted to the mission architect, or could expand to include the mission architect functions; the deputy chief of staff for Air and Space Operations (AF/XO), which could have some conceptual functions shifted into the capability plans and concept sponsorship role, or could assimilate all of that role; the acquisition directorate for Science, Technology, and Engineering (SAF/AQR) which could also see functions shifted to capability plans; and other acquisition directorates, which would have less say in pre-Milestone B activities. Still other organizations might establish “dotted line” relationships with the mission architect and concept sponsor, for instance, space architecture and acquisition functions of the Undersecretary of the Air Force.

<sup>5</sup> Gen Ryan memo; AFRD 10-28, 2-3.

<sup>6</sup> Dr. Levis interview.

<sup>7</sup> Architectures are admittedly a daunting challenge. The ideas are inherently difficult for “amateurs” to grasp, and the descriptions will need to be detailed enough to ensure coherence yet not so much as to become unwieldy. To pull off this delicate balancing act will require time, patience, substantial education and training, and ultimately, trust in smart people to get the job done.

<sup>8</sup> For instance, a concept or program could be described by a capability “score vector” comprised of standardized scores from each Task Force and applicable functional area (like space); along with appropriate metrics on cost, schedule, risk, interdependency, and so forth.

<sup>9</sup> Milestone A gives approval for a project to enter “concept and technology development” based on its potential to meet identified needs from a mission area integrated architecture, analysis of alternatives, etc. It does not yet establish a formal acquisition program, thus it seems that a more flexible approval authority is warranted.

<sup>10</sup> Ideas would include both material and non-material concepts, preferably integrated at the “capability package” level. By ensuring that these are associated with Task Force CONOPS “threads” and other future operational concepts, “futures” wargames (still a useful part of long range planning) could become a bit less dependent on force structure “gadget lists” and more focused on a balance between innovative CONOPS, organizations, and technology.

<sup>11</sup> It is not obvious who would be best positioned to draft the AF planning guidance and investment strategy under the recommended organizational construct. For instance, the mission architect would tend to emphasize conformity with Task Force and architectural priorities, whereas the capability planner would be expected to push for breadth of innovation and “design space” for investment distribution. MAJCOMs and programmers would press to preserve status quo budget levels. The overall guidance and “strategic buckets” should seek to balance these somewhat offsetting pressures to achieve the ideal of “control without control.”

<sup>12</sup> Dr. Levis interview. The AF chief scientist’s office, AF chief information officer, and AF Command and Control and ISR Center have co-sponsored an architecture course already. See Levis et al., C4ISR Architecture Framework Implementation Course.

<sup>13</sup> For example, Institute for International Research - USA, “NPD Portfolio Management—Conference Overview,” on-line, Internet, 2 November 2002, available from <http://www.iirusa.com/portfolioseminar/>.



## **Part 8**

### **Conclusions**

The chief of staff has articulated a compelling vision for the future of Air Force modernization planning, based on a family of effects- and capabilities-based Task Force CONOPS. The initiative is off to a deliberate but promising start, paced by the completion of the initial CONOPS versions and the ongoing first round of the Capabilities Review and Risk Assessment (CRRA). Task Force Champions are now established within a full-time Air Staff organization; they are working with Air Force programmers to converge on a new set of capabilities-based adjustments to PPBS processes. The CRRA is gradually emerging as a potent tool for linking desired capabilities to program priorities and resource decisions. Requirements may soon be linked to Task Force CONOPS and CRRA results, and eventually, architectural descriptions will likely become part of the CONOPS as the headquarters slowly climbs the architecture learning curve. Quality work is underway, and it may well instigate changes throughout the Air Force's key corporate processes within the next two years. The result could be a new "control system" to communicate priorities, assess progress, and impose feedback controls on modernization-related activities. However, the ultimate success of the initiative is not yet a given.

This paper has argued that the approach, though promising, must be enhanced if it is to cope with several formidable pressures within DoD and the Air Force. The new control system

will necessarily co-exist with DoD and joint controls, and must respect certain “boundary conditions” dealing with transformation priorities, effects-based thinking, joint architectures and interoperability, joint assessment mechanisms, spiral acquisition, and directed reorganizations. These conditions can align favorably with the Task Force initiatives, but only if they are recognized, accounted for, and proactively leveraged within a balanced Air Force framework. So far, this has happened only partially. A number of difficult issues and challenges are looming that threaten to undermine, the overall effort. The issues are mainly driven by (1) current stovepipes and misalignment both within Air Force processes and organizations, and between AF and counterpart joint processes; (2) the quality and alignment of information available for planning and decision-making; and (3) seams in content and accountability within the new initiatives as well as in legacy AF structures. The majority of driving issues must be resolved if the Task Force efforts are to benefit modernization processes. Currently, the Task Force initiatives look less coherent and appealing to stakeholders outside the Pentagon than to those closely involved with the changes.

A number of “good idea” alternatives have been considered to address the driving issues. This analysis has shown that architectures, lower-level CONOPS definition, value models, integrated portfolio management, and a “control without control” approach are promising vectors along which to begin additional changes. While all of these have unique merits, none by itself offers a robust solution to the majority of issues. A comprehensive solution seems to require a “composite approach” that can draw on the best features of the alternatives—deployed in a logical progression of “modest steps” vice a single sweeping change of direction.

This resulting composite approach is designed to balance several key themes within an integrated, capability-based modernization framework. It includes top-down processes for

strategic guidance, mission architecting, CONOPS and requirements definition, portfolio management, programming, and integrated decision-making—with the latter spanning PPBS, acquisition milestones, portfolio reviews, and other approval gates. This approach counterbalances top-down controls with bottom-up emphases on innovative capability design, concept exploration, and science and technology investment. A pervasive and common assessment methodology enables balance and integration among these processes, implemented in terms of a “common scorecard” and other decision support enhancements. This approach aggressively pursues both vertical and horizontal process integration and pushes for joint compatibility.

Several significant “power shifts” will occur in adopting the recommended approach. First, it will add importance and accountability to the mission architecting, strategic planning, and capability planning roles and functions. These functions will co-exist in a state of creative tension that seeks to balance controls with the freedom to innovate. It also elevates the status of analysis and assessment roles—which must now muster the resources, tools, and skills to impose rigor within the common assessment methodology. Second, the integrated framework will slightly reduce the authorities of centralized acquisition and programming functions—particularly in their influence over “up front” concept development decisions. However, these functions share a new responsibility to facilitate integrated decision-making. Finally, the framework will leave authority and influence levels approximately unchanged for MAJCOM functions, centralized requirements management, and senior decision-making (mainly by the chief and secretary of the Air Force). Though a net shift in power is not intended for these actors, the new framework should give them better guidance, data, and other “connective tissue” to use in accomplishing their specific modernization roles and functions. Of course, these power

shifts will vary depending on the specific organizational structure that is adopted. The themes of the composite approach could surely be implemented within a variety of organizational schemes. The suggested scheme is an illustrative, notional construct that realigns some current functions in order to (1) drive the recommended process changes, and (2) ensure an approximate balance of power among corporate functions.

An abstract framework can only do so much to engender change. Ultimately, people will need to make it happen, and having talented people in the right places will be more important than the “methodology” for implementation. However, simply bringing the best operators, developers and technologists together within Task Forces will not be enough. Teams will do their best under the circumstances, but are unlikely to produce consistent architectures, roadmaps, and analytical frameworks without the right mix of education, training, and guidance. Freedom to innovate is important, but the Air Force must first ensure that appropriate skills are developed, and that certain bounds and controls are in place to provide a measure of stability. People and organizations will need clear authority, accountability, and a sufficient change mandate to fully activate their creative energies.

An integrating context for change is paramount to create the stable foundation for success. Thus, the Air Force will need to articulate a comprehensive modernization policy that connects Task Forces, programming, architectures, and other corporate functions (requirements, acquisition, planning, assessment), and authorizes required changes in organization, staffing, education, and training. The overall “structure” that is imposed in a comprehensive modernization framework need not be supremely detailed or restrictive; but a complete picture of its basic dimensions and purposes does need to be clearly communicated to stakeholders, to ensure that this “big picture” is grasped at all levels within the Air Force. Loose ends need to be

tied up in both the lexicon and in the horizontal and vertical distribution of responsibilities, to preclude false starts and wasted efforts. The “message” needs to acknowledge that change will not be easy, and that tensions will remain between bottom-up innovation (in concepts, experiments, and rapid acquisition) and top-down controls (via strategic guidance, architectures, interoperability, and common assessments). It must however make a case for keeping these healthy tensions in balance “at the edge of order and chaos” as the right answer to the modernization challenge.

Once the basic conditions for success are created, specific actions can be put on a fast timeline to meet most “threshold” goals within about two years. Additional risks can then be taken and more aggressive changes pursued—to fully integrate corporate decision processes and to fully balance roles and accountability within the framework, thus maximizing its effectiveness and efficiency. The “composite objective” alternative stands as a model and aim point for these longer-term enhancements.

In the process, the Air Force will be moving to synchronize the “dominant” PPBS rhythms and activities with architecture development, acquisition and requirements decisions, and revitalized strategic planning—thereby paralleling all of the “sea changes” taking place in the DoD and joint policy arenas. The new DoD and joint policies mostly “get it right,” but it may take considerable time for coordinated joint implementation to begin. Promising brushfires are starting in several places, and it will benefit the Air Force to get in synch with them—and ideally take a leading role—as the processes begin to synchronize.

These changes may greatly enhance U.S. national security. To respond to tomorrow’s unpredictable, fleeting, and asymmetric threats, US forces will need to be agile, adaptable, and networked. This calls for rapid, spiral development of concepts and systems to provide modular,

interoperable building blocks of capability—enabled by a disciplined yet innovation-friendly structure for planning, architecting, and programming. This approach is not just an option to use the latest set of “reengineering and reform” buzzwords. It seems to be the only viable strategy to ensure that DoD capabilities are well postured to anticipate and respond to the challenges of the future. The Services cannot afford to be bogged down in stove-piped acquisition programs with 15-year development cycles that are out of synch with emerging requirements, or with a PPBS focused on urgent near-term fixes. With billions of dollars and our national security at stake, the opportunity to build an integrated capabilities-based modernization framework is certainly worth seizing. A reasonable path toward achieving this framework must be laid out today. Given tomorrow’s increasing security challenges, the Air Force cannot afford to take the opportunity lightly..

## **Appendix A**

### **Conceptual Modernization Frameworks**

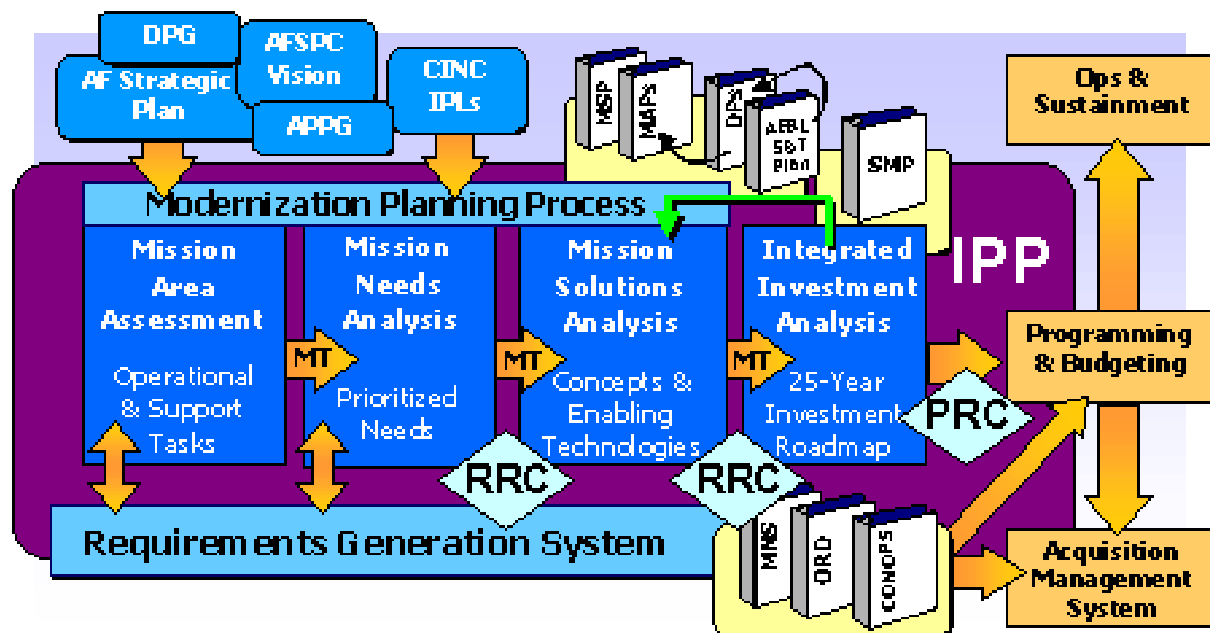
This appendix provides an overview of existing conceptual frameworks or methodologies for translating strategic priorities into resource decisions. These provide at least a partial basis for several of the alternative “vectors” described in Chapter 6 (see Table 2).

#### **Air Force MAJCOM “Integrated Planning Process”**

The Air Force uses a decentralized strategic planning and programming process to build the elements of its annual Program Objective Memorandum (POM). In the first stage of this so-called “integrated planning process,” MAJCOMs maintain and update their Strategic Master Plans (SMP) and related documents. These plans are shaped by top-down strategic direction—visions, strategies, guidance, and priority lists provided by DoD, the Air Force, and combatant commanders—but updated annually (and independently) by each MAJCOM via bottom-up analyses within a “strategy-to-task” framework.<sup>1</sup> Specific steps include:

- Mission area assessment—what tasks need to be done in the mission area?
- Mission needs analysis—what are the deficiencies in being able to perform the tasks?
- Mission solutions analysis—what materiel and non-materiel solutions are promising?
- Integrated investment analysis—what programs give the best “bang for the buck” in addressing the tasks and deficiencies?

Figure A-1 depicts the process steps used at Air Force Space Command (AFSPC) and Air Force Special Operations Command, and the key outputs.<sup>2</sup>



### Figure A-1. AFSPC Integrated Planning Process



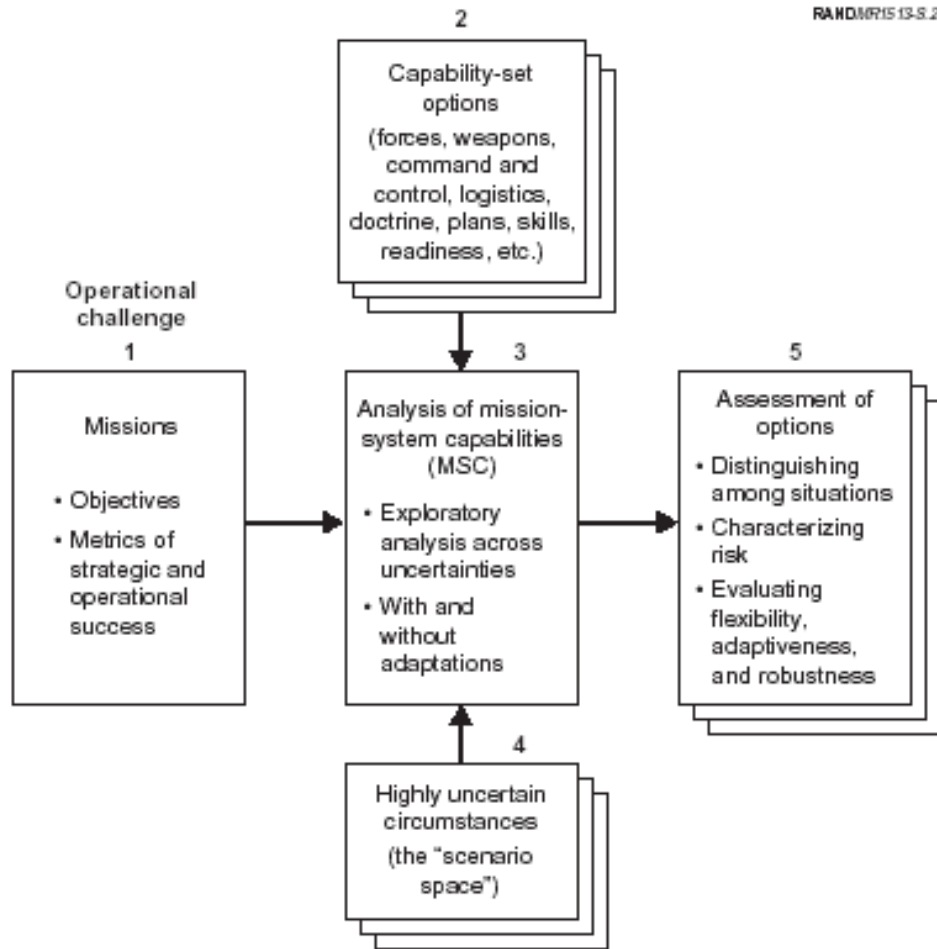
In the next stage, MAJCOMs prepare inputs to the annual programming cycle—that is, the MAJCOMs’ inputs to the Air Force POM. In principle, programs would be laid in as driven by the SMP or some other governing master plan.<sup>3</sup> In reality, the SMP (or MAP) provides a raw guideline, but the MAJCOM’s POM recommendation is built by a combination of semi-quantitative rationale from the integrated investment analysis,<sup>4</sup> subjective judgments by MAJCOM-level mission teams and programmers, MAJCOM-level issue resolution (including various cut drills and political wrangling), and ultimately by the MAJCOM commander’s priorities. The aggregate funding profile for the MAJCOM’s portfolio of programs must fit within the fiscal guidelines provided by Headquarters USAF. MAJCOMs cannot afford to fund everything they need, or even close to it, so difficult choices must be made in preparing the POM for submittal to the headquarters.

Despite the intense competition for funds, the MAJCOM process for building its portfolio of programs concentrates attention and decision-making “on the margins” of the portfolio. This happens because Air Force programmers make a simplifying assumption—that programs already funded in previous POM cycles do not need to be re-defended to any great extent. These baseline programs consume a significant fraction of the available budget. Thus, a large number of projects and programs are left to fight for the limited funds remaining to pay for “disconnects” (where additional money is needed for ongoing projects) or “initiatives” (new efforts seeking new funding). The MAJCOM *does* look for baseline programs that can become potential sources of money—those from which “offsets” can be taken due to changes in user priorities, fact-of-life adjustments in program content or schedule, and so forth. However, offsets tend to be limited. With little room to make changes “on the margins,” a typical MAJCOM POM

submittal might include only a handful of initiatives, and possibly none at all. This limits the amount of “transformation” possible within the portfolio.<sup>5</sup>

### **Davis’ “Mission-System Analysis”**

Davis’ model for capabilities-based planning emphasizes flexibility, adaptiveness, and robustness; and requires “systems thinking” and a modular, building-block approach to force design and operations. The analytical method, termed “mission-system analysis,” is depicted in Figure A-2. It includes the following key steps: (1) identify capability needs and key “operational challenges” based on a wide range of illustrative scenarios; (2) assess capability options—alternative concepts of operations and the forces and programs to enable them—for effectiveness in accomplishing stressing building-block missions; (3) use a “mission-system description” (essentially a “logic tree” of capabilities, tasks, and systems involved in meeting a stressing challenge) and exploratory analysis to ensure that critical modules are both complete and robustly capable across a range of circumstances; and (4) make choices about requirements and ways to achieve them within an integrative portfolio framework, subject to economic constraints; using both “hard” analysis and judgment to make tradeoff and balancing decisions.<sup>6</sup>



Source: Davis, *Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation* (2002)

### Figure A-2. Mission-System Analysis

In Davis’ planning framework, “exploratory analysis” is performed using a family of models and games to assess how well capability packages perform across a range of scenarios. He recommends exploratory analysis in combination with “strategic thinking, heuristics, and portfolio management” to attempt to deal with high-level integration and tradeoffs among programs.<sup>7</sup> Decision-support tools are available for this purpose, including a RAND application (DynaRank) that works within a resource allocation framework to assess investments “on the margins” of a portfolio.<sup>8</sup>

Davis' approach is an efficient response to broader DoD pressures to improve the quality of decision support data and tools (such as modeling and simulation). The vision of being able to “prove” the utility of a concept in various scenarios, by analysis—without having to expend resources for “real” demonstrations—is a lofty and long-standing one, but one that has proved exceedingly difficult to realize.<sup>9</sup> No single simulation can begin to address the scope of potential questions that might be asked. Moreover, the traditional emphasis on campaign-level analysis is antithetical to capabilities-based analysis, which is best done within bounded mission domains. Operations or missions, not total wars, are associated with critical building-block capabilities.<sup>10</sup> The difficulties are even greater in moving toward analysis of effects-based operations, which requires cognitive modeling and other tools that go well beyond traditional attrition-based models.<sup>11</sup> Current models already struggle to predict the effects of C4ISR, information operations, and other non-kinetic actions. Thus, analytical frameworks are likely to remain dominated by subjective methods, while pressure persists to improve the quantitative models and simulations.

#### **Kent and Ochmanek “Framework for Modernization”**

Another RAND effort, that of Kent and Ochmanek, provides suggestions for a modernization framework to specifically leverage and enhance the chief of staff's Task Force CONOPS theme.<sup>12</sup> Kent and Ochmanek propose (1) a clear terminology for the hierarchy of military capabilities and operational concepts, (2) a categorization of the actors involved in guiding and promoting innovation, (3) a process to govern the interactions of those actors, and (4) a list of the operational challenges that could be used to organize the efforts of Task Force Champions and others.

Terminology is based on a hierarchy of CONOPS, CONEMPs and CONEXs originally proposed to the AF during an earlier CONOPS initiative.<sup>13</sup> These concepts can be defined as follows:

- **Concept of Operations (CONOPS):** a concept defining the means for achieving a stated operational objective or set of objectives (e.g., the objectives associated with producing the desired effects within a Task Force mission area); in the latter case, is comprised of the CONEMPs for achieving the constituent objectives
- **Concept of Employment (CONEMP):** an approach for achieving a stated operational objective; defines the set of military tasks to be accomplished over time
- **Concept of Execution (CONEX):** an end-to-end concept for accomplishing a particular military task; an important type of CONEX involves “dynamic engagement control,” integrating the activities of “finders,” “controllers,” and “shooters.”<sup>14</sup>

The hierarchy and similar definitions were “accepted” by the Air Force and written into AFRD 10-28, but never implemented to a great degree; it is not known whether the expected revision to AFRD 10-28 will continue to endorse the RAND hierarchy.

CONEMPs and CONEXs are the key tools used by “actors” in the recommended modernization process. Seven principal actors are involved within a Service. These are:

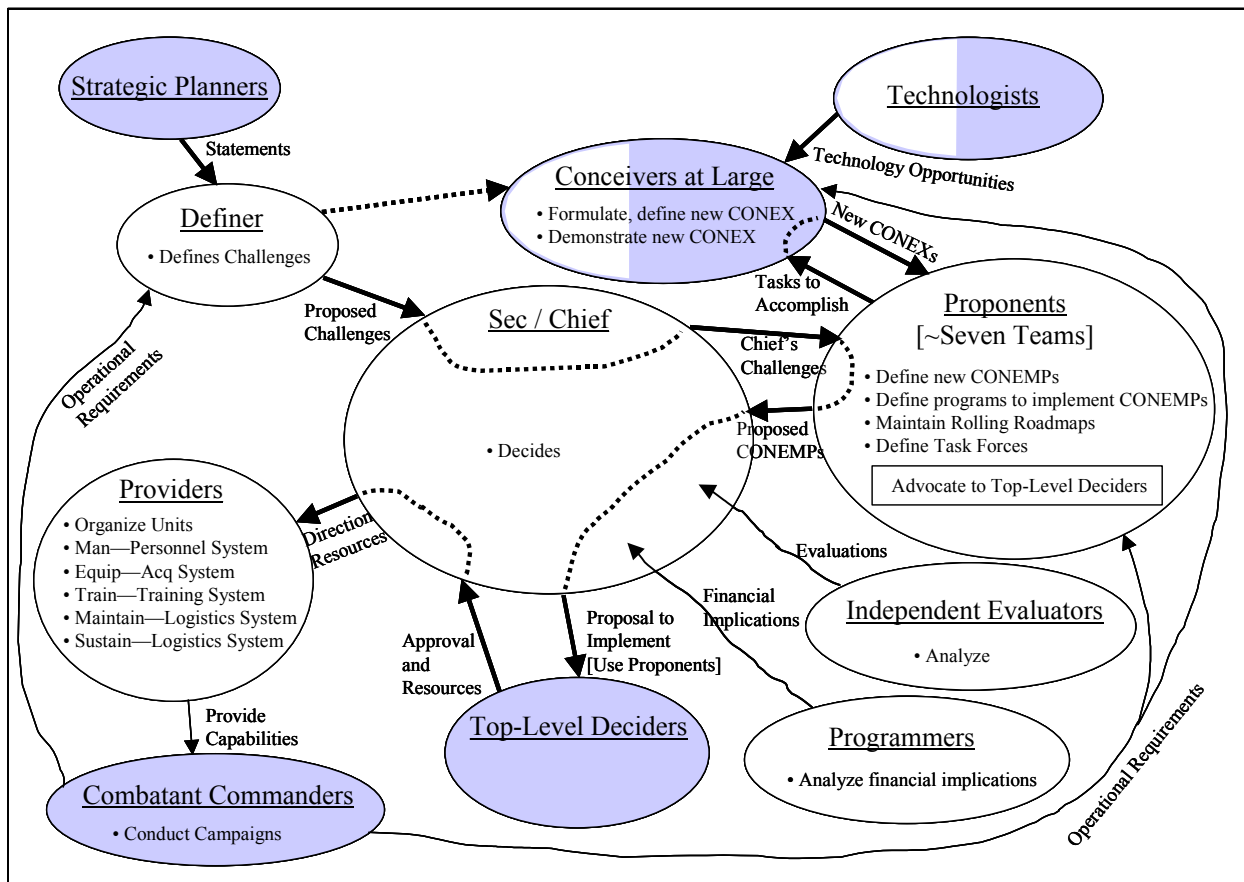
- **The Definer:** chief role is to frame a finite set of high-priority operational challenges that the AF will strive to meet.
- **The Conceivers:** formulate, define and, when appropriate, demonstrate new CONEXs;
- **The Proponents:** define new CONEMPs to address a related set of operational objectives under each operational challenge; monitor and assess the AF capabilities to achieve those objectives; and seek to ensure that adequate resources are allocated within

the AF to sustain and advance “their” set of operational capabilities; also advocate to authorities outside of the AF

- **The Independent Evaluators:** advise the secretary of the Air Force and the chief of staff on the merit of any proposed new concepts
- **The Programmers:** estimate the cost of proposed concepts and propose ways for balancing resources across all AF activities
- **The Providers:** provide capabilities to combatant commanders by implementing new CONEXs and CONEMPs
- **The Secretary of the Air Force and the Chief of Staff:** preside over the entire process and render decisions at key points; “decision points” include approval of operational challenges, choice of whether to pursue a concept proposed by the Proponents, and how best to advocate for resources for concepts.

Proponents play a key, integrating role and would be analogous to the current Task Force Champions—though Kent and Ochmanek recommend that brigadier generals occupy these positions rather than colonels. Each Proponent would lead a team responsible for an operational challenge (and its associated objectives and tasks). The suggested set of seven critical challenges is comparable to the seven AF Task Force areas, but differs in some areas.<sup>15</sup> Also, the authors acknowledge that a one-for-one correlation between their model and the organizational charts and structure of the Air Force is not obvious.

Kent and Ochmanek go on to further describe the responsibilities of each actor and to define the relationships among them. The recommended process framework for spurring and managing innovation is shown in Figure A-3. Shaded or partially shaded blocks depict non-AF contributors to the process (e.g., DoD or joint leaders, and industry).



Source: Kent and Ochmanek, *A Framework for Modernization* (2002)

**Figure A-3. Master Framework for Modernizing**

### DoD “Joint Integrated Architecture”

DoD Instruction 4630.8 lays out a process to use joint integrated architectures in a framework for developing, testing and fielding interoperable systems. Key concepts in this framework include the following:<sup>16</sup>

- **Operational Concepts and DoD Joint Integrated Architecture.** Based upon evaluation of a dynamic and unpredictable operational environment, operational concepts will be proposed. The Joint Operational Architecture and associated Joint Mission Areas,

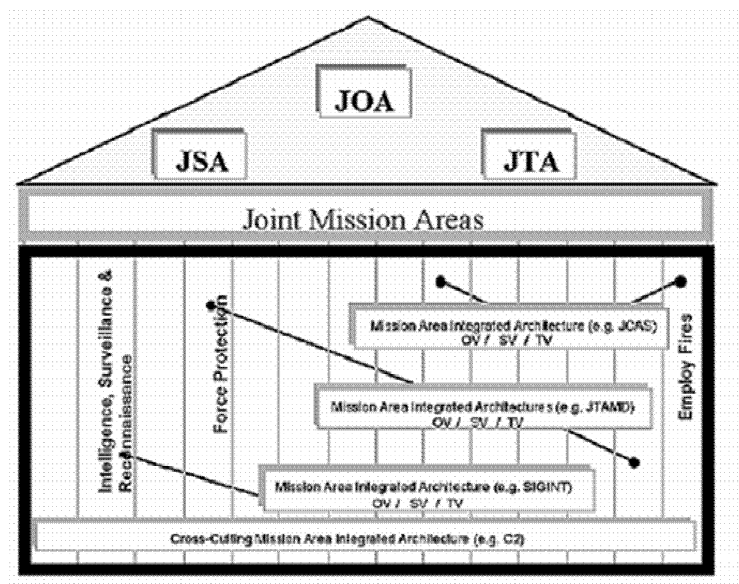
the Joint Systems Architecture, and Joint Technical Architecture are derived from, and responsive to, these operational concepts.

- **Joint Operational Architecture.** The Joint Operational Architecture is a description of tasks and activities, operational elements, and information flows required to accomplish or support military operations. It is intended to represent the entire spectrum of joint operations and will be further subdivided into a set of Joint Mission Areas.
- **Joint Systems Architecture and Joint Technical Architecture.** The Joint Systems Architecture identifies and describes all DoD systems and their interconnections necessary to accomplish the tasks and activities described in the Joint Operational Architecture. The Joint Technical Architecture defines the interface standards and rules governing interdependence of system parts or elements (e.g., use of commercial open systems standards for information technology).
- **Joint Mission Areas.** A Joint Mission Area represents a functional group of joint tasks and activities that share a common purpose and facilitate the operation and interoperability of joint forces. Joint Mission Areas provide a context for those “family of systems” and “system of systems” relationships sharing a common mission area.
- **Mission Area Integrated Architectures.** From the Joint Mission Areas, DoD components are to develop mission area integrated architectures consisting of three correlated “views” of the family-of-systems or system-of-systems architecture for the mission area. As specified in the C4ISR Architecture Framework, these views are an Operational View (OV) describing tasks and activities, operational elements, and information flows; a Systems View (SV) describing the systems and system interfaces supporting the operational nodes; and a Technical View (TV) listing the standards and



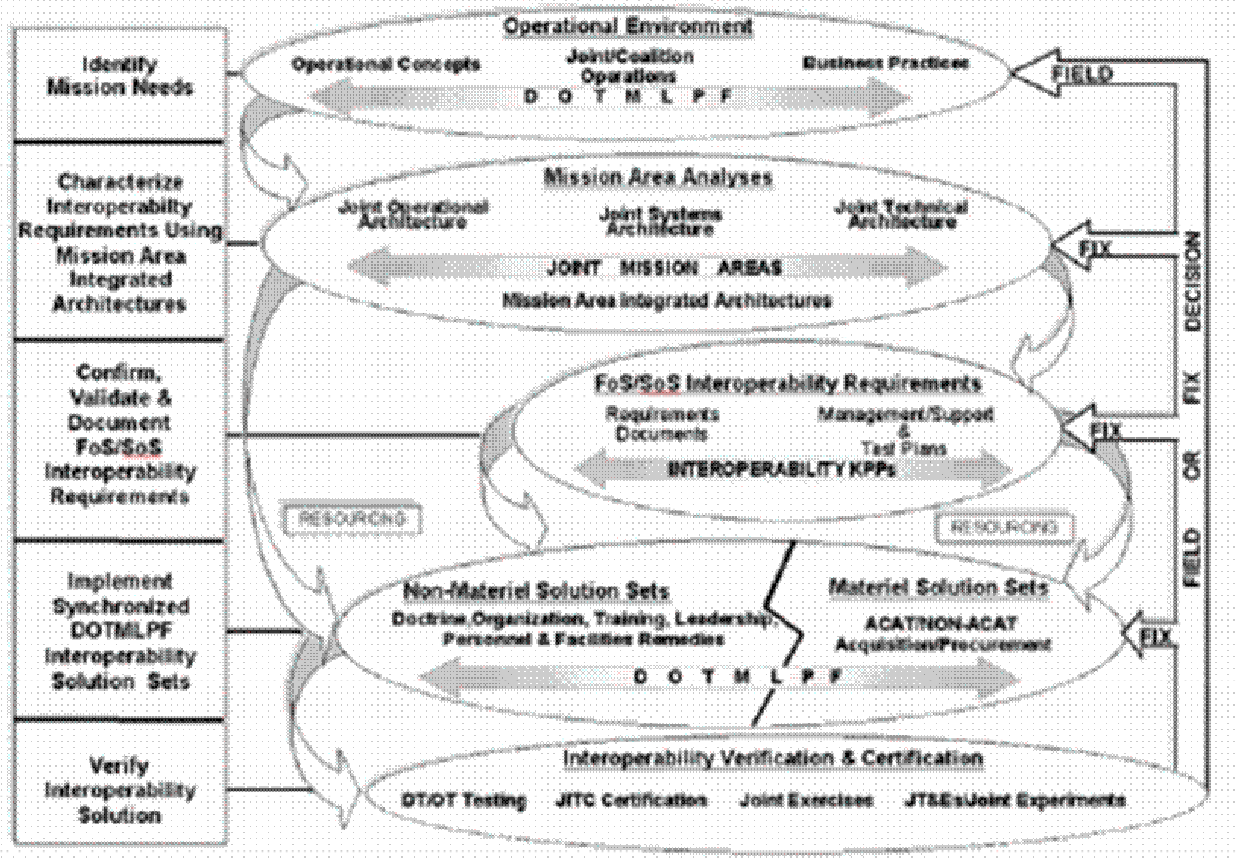
rules governing interdependence of system parts or elements. Mission area integrated architectures become the common foundation for interoperability and supportability processes for acquisition programs and fielded capabilities.

Figure A-4 shows the overall notional construct of the DoD Joint Integrated Architecture. Figure A-5 depicts the process whereby interoperability is ensured through a structured flow down of architectural guidance, from operational concepts, to joint architectures, to system-of-systems requirements, and finally to non-materiel and materiel solutions and acquisition programs.



Source: DODI 4630.8 (2002)

**Figure A-4. DoD Joint Integrated Architecture**

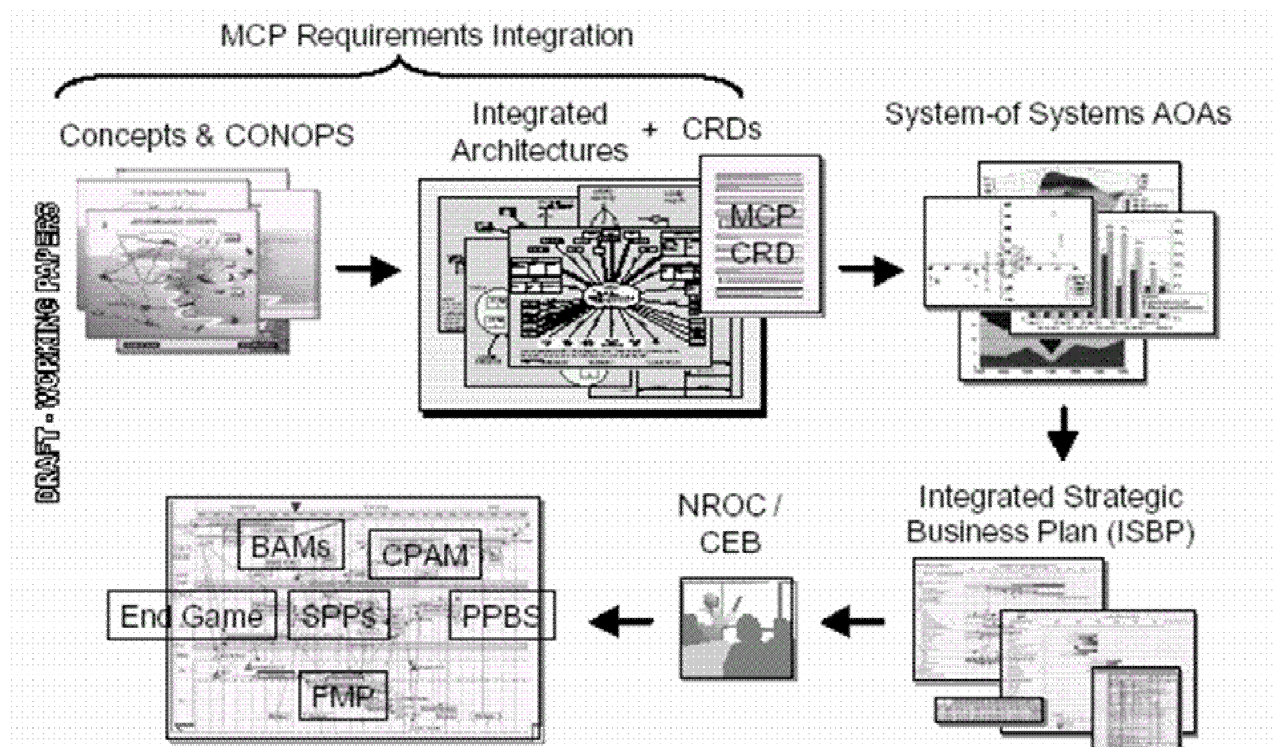


Source: DODI 4630.8 (2002)

Figure A-5. Outcome-based Interoperability Process

### Navy “Mission Capability Packages”

Navy “chief engineer” and “warfare integration” offices have articulated a planning concept based on “mission capability packages” (MCP). The MCP methodology synthesizes ideas from network-centric warfare, architecting, and system-of-systems engineering. It links mission tasks and objectives to programming recommendations, using “integrated architectures” and system-of-systems analyses as connective steps in the process. Figure A-6 shows the conceptual logic flow of the MCP-driven framework.<sup>17</sup>



Source: Yurchak, "Battle Force Capabilities / Mission Capability Packages (2001)

Figure A-6. MCP Planning Process

Each MCP is described as a task-organized “bundle” that includes CONOPS, processes, organizational structures, networks, systems (sensor, weapon, command and control), people, training, and support services—an alignment tool that addresses critical operational tasks in an integrated system context vice as a “collection of things.” The MCP forms the basis of architecture development and of assessments to identify gaps and priorities for POM funding.<sup>18</sup> Architectures are aligned with MCPs and help to describe them; however, an architecture framework is just part of the MCP structure and process. Key elements in the flow of the MCP planning process include:<sup>19</sup>

- Concepts and CONOPS
- Integrated architectures (including capstone requirements)

- System-of-systems analyses of alternatives
- Integrated strategic business plan
- Senior leadership reviews and milestone decisions
- PPBS and other detailed financial and program plans.

The Navy offices propose that this approach can link the key DoD decision support systems—requirements generation, acquisition management, and PPBS—within an integrated architecture framework. The objective is to make acquisition milestones and program planning and resource decisions depend on compliance with validated and approved integrated architectures.<sup>20</sup> (The AF chief scientist acknowledges the Navy’s progress in architectures, but also notes that architectures are neither integrated nor integrable—it is the underlying data that must be.<sup>21</sup>)

The idea of the mission capability package originated in theories of Network Centric Warfare, where it was defined as follows:

An MCP consists of a concept of operations, command approach, organization, systems, and people with a prescribed level of expertise. Implicit in an MCP is the nature, distribution, and utilization of information. The process of engineering an MCP needs to encourage and facilitate the co-evolution of its component parts right from the start. The melding of (these components) into a coherent MCP is essentially an interdisciplinary learning process that is one part discovery, one part testing, and one part practice.<sup>22</sup>

Network Centric Warfare ideas go well beyond this definition, providing guiding principles to enable each dimension of an MCP to “be all it can be.”

The amount of detail in an “ideal” MCP would evidently be a good model for a “capability package” associated with a Task Force CONOPS. A Task Force Champion would be pleased to be armed with the level of detail (in the CONOPS and CRRA capability lay down) that is ascribed to the “ideal” MCP concept above. Considering that each broad Task Force may require that the equivalent of several MCPs be defined to cover its range of sub-missions and

tasks, the Air Force has a long way to go to achieve this level of detail. (The same is probably true elsewhere in DoD.)

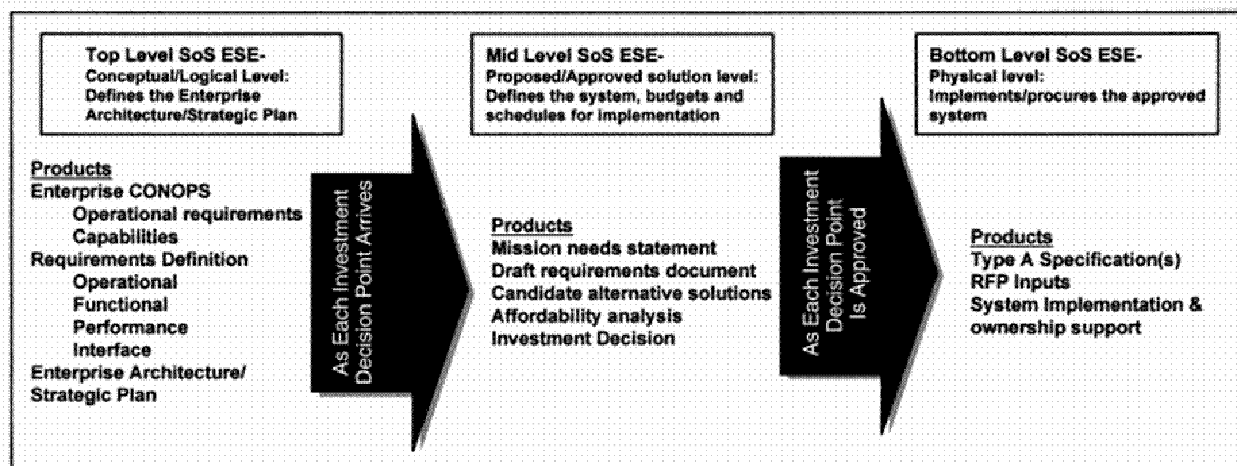
### **Carlock and Fenton “System of Systems Enterprise Systems Engineering”**

The Federal Aviation Administration is using an architecture-driven approach to guide the implementation of a new National Airspace System.<sup>23</sup> Carlock and Fenton describe the general approach used by TRW engineers in this and other federal projects as “system of systems enterprise systems engineering.” As a multi-level extension of traditional systems engineering disciplines, it develops and links CONOPS, system-of-systems architecture, a systems development roadmap, and the associated systems acquisition projects under the system-of-systems architecture umbrella.<sup>24</sup> It offers a “proven” model for the Air Force to consider in connecting Task Force CONOPS to capabilities and then to systems within a disciplined architectural construct. The model would apply at the Task Force level, or more likely, at the level of a “capability package” within a Task Force—specifically, at whatever level makes most sense for setting up a bounded system-of-systems to accomplish a critical mission.

The approach incorporates lessons learned from the authors’ experiences with system of systems (SoS) development, generally a much more complex job than building a stand-alone system. Unique challenges include the need to field and integrate new systems into the SoS while maintaining legacy systems, so as not to lose capability during transition; and the need for government SoS integration personnel with appropriate skills and experience in building large complex systems. Classical systems engineering approaches must be extended to meet these SoS challenges. Carlock and Fenton describe a three-tiered process to impose the required discipline and rigor, as summarized in Figure A-7. The tiered approach breaks the SoS development problem into manageable pieces, applies appropriate controls and traceability, and is flexible

enough to accommodate changing budgets, requirements, and “what if” drills. Major elements of the approach are:<sup>25</sup>

- Ensure government engineering team has strong expertise in operations, business and system development
- Use a disciplined, structured process and information management tools
- Provide checks, balances, and approvals of all critical government SoS products
- Define, plan, document, review, and approve the life cycle of the SoS at the conceptual level, and keep the description current
- Scrutinize each new system to be implemented, provide sufficient detail for investment decisions and to understand SoS-level costs and benefits
- Select and monitor implementation contractors for each approved system.



Source: Carlock and Fenton, “System of Systems (SoS) Enterprise Systems Engineering for Information-Intensive Organizations” (2001)

Figure A-7. SoS ESE Levels, Process, and Products

## **Cooper et al. “Integrated Portfolio Management”**

Research on industry “best practices” encourages a dynamic view of new product portfolio management, in terms of both the timing and scope of portfolio reviews. Cooper et al. have developed guidelines for integrating portfolio decision processes, and for choosing appropriate assessment tools and techniques. The authors define “portfolio management” as

a dynamic decision process, whereby a business’s list of active new product (and R&D) projects is constantly updated and revised. New projects are evaluated, selected and prioritized; existing projects may be accelerated, killed, or de-prioritized; and resources are allocated and re-allocated to the active projects.

The portfolio decision process encompasses or overlaps a number of decision-making processes within the business, including periodic reviews of the total portfolio of projects (comparing all projects against each other), making Go/Kill decisions on individual projects on an on-going basis (using gates or a stage-gate process), and developing a new product strategy for the business, complete with strategic resource allocation decisions.<sup>26</sup>

Although this process appears to mirror DoD processes—including PPBS resource allocation, acquisition phases (“stage-gate process”) and milestone decisions (gates), and project portfolio reviews (like the Air Force CRRA or QAPR)—the industry best practice is to tightly integrate these decision processes. Cooper et al. describe two options for the integration:

- A “gate-dominated” process, whereby both Go/Kill decisions and resource allocation commitments are made at gate meetings for individual programs. Overall portfolio reviews are held periodically as more of a rubber-stamp review of the decisions made at the gate meetings.
- A “portfolio review dominated” process, where all programs at or past “Gate 2” are put on the table to be reviewed (two to four times per year) for resource allocation and prioritization. Gate meetings are secondary and serve mainly to verify that programs remain financially sound, on schedule, and so forth.

In either “best practice” scheme, portfolio management normally kicks in at Gate 2 in the stage-gate process, the gate between preliminary investigation of a new product, and detailed investigation (where the business case is built).<sup>27</sup> This gate is the equivalent of the DoD’s “Milestone B” where concept and technology development transition to system development and demonstration—probably the most sensible point at which to attempt integration of acquisition management and PPBS “full funding” considerations.

A variety of portfolio management tools and methods can be used to conduct the integrated assessments and establish priorities. Cooper et al. recognize that no single method is clearly best. They suggest a hybrid “strategic” approach: first set up “strategic buckets” based on the overall corporate strategy; allocate resources into these buckets; then prioritize the projects within the buckets using a scoring model or some other ranking approach. The scoring then becomes a living process: “Employ scoring models at gate meetings to make Go/Kill and prioritization decisions; and utilize the project scores to help make prioritization decisions at periodic portfolio review meetings.”<sup>28</sup>

### **Waldrop’s “Control Without Control”**

Ideas from “complexity theory” provide a “rich source of new metaphors” to help understand change and innovation in today’s knowledge-based, globalized society, offering advantages over previous “scientific management” theories in describing complex systems.<sup>29</sup> Complex systems—in physical, biological, social, economic, cognitive, and computational sciences—tend to share the common characteristics of being decentralized, with many “agents” constantly interacting and adapting in a massively parallel structure. Interacting agents are free to do their own thing, but “good things happen anyway.” However, something more is



required—a “framework” involving some degree of law, regulation, policy, customs, and norms, that enables a state of “control without control” to be achieved.

Waldrop defines a framework as “an environment in which individual choice, individual initiative, and individual interests have free reign—and yet converge on a desirable result anyway.” The challenge in creating a framework is to find the “vital center”—the right degree of regulation, lying between the extreme conditions of tightly controlled management and a “sandbox” environment. The following features are identified as key elements in a common framework for innovation:

- An atmosphere of trust, allowing fast response and freedom to make mistakes
- A compelling mission
- The right people, including bureaucratic allies and supporting centers of excellence
- Communication and feedback
- A self-exciting system, including handpicked successors and appropriate education.

Waldrop cites the development of the Internet and other computer innovations by the Advanced Research Projects Agency, beginning in the late 1950’s, as a prime example where these principles were put into action.

## Notes

<sup>1</sup> For an example SMP, see Air Force Space Command, *Strategic Master Plan FY04 and Beyond* (Peterson AFB, CO: AFSPC/PA, 5 November 2002), 11-13, on-line, Internet, 13 December 2002, available from <http://www.spacecom.af.mil/hqafspc/library/AFSPCPCAOOffice/Final%2004%20SMP--Signed!.pdf>.

<sup>2</sup> Air Force Space Command, “Appendix A: IPP Process Description,” on-line, Internet, 13 December 2002, available from <http://www.spacecom.af.mil/hqafspc/library/AFSPCPCAOOffice/AppendixA.htm>.

<sup>3</sup> For example, the National Security Space Master Plan, a product being coordinated by the undersecretary of the Air Force in his new role as DoD Executive Agent for Space. This plan is intended to lay out a 10-20 year roadmap for all national security space systems being developed by the military services and other agencies, including the National Reconnaissance Office.

<sup>4</sup> “Semi-quantitative” in the sense that a formal “scoring model” may be used, but the evaluation criteria and scoring methods embedded in the model may be quite subjective. Also, program or concept data used to populate the models are often approximate at best.

## Notes

<sup>5</sup> A fundamental cause for concentrating around the margins of the portfolio is that the Air Force approach to programming involves consensus-built decision-making. This reduces most decisions to the margins because, in the interest of getting agreement, difficult issues are ignored or pushed aside. See Lewis et al., 31.

<sup>6</sup> Davis, xi-xxiv.

<sup>7</sup> Ibid., xviii, 44.

<sup>8</sup> Hillestad and Davis, 1-9.

<sup>9</sup> DoD and Service efforts to develop “comprehensive” campaign-level simulations such as JWARS, TACWAR or THUNDER are testaments to both the appeal, and the difficulties in the vision. Of course, the pressure to establish more credible “proof” of utility or interoperability for new concepts also drives the current emphasis on experimentation—a theme in the QDR, Joint Vision 2020, and other strategic guidance.

<sup>10</sup> Davis, xviii.

<sup>11</sup> Uchida, A8-5-A8-8.

<sup>12</sup> Kent and Ochmanek, iii-vii, 1-36.

<sup>13</sup> Ted Warner and Glenn A. Kent, “A Hierarchy of Operational Concepts (CONOPS, CONEMPs, CONEXs) Describing How Aerospace Power Provides Capabilities to Defend the Nation” (briefing, RAND – Project Air Force, Washington, DC, May 2001), 1-30.

<sup>14</sup> Kent and Ochmanek, 6-9; Warner and Kent, 3-6, 13, 24.

<sup>15</sup> Kent and Ochmanek, 20-24.

<sup>16</sup> DoDI 4630.8, 25-28.

<sup>17</sup> Yurchak, 15.

<sup>18</sup> Walton, 4-5, 11.

<sup>19</sup> Yurchak, 16-22.

<sup>20</sup> Ibid., 9.

<sup>21</sup> Levis, “Architectures,” 11; Levis interview.

<sup>22</sup> Alberts et al., 193, 197.

<sup>23</sup> Information on the time-phased National Airspace System architecture (version 4.0) can be found at <http://www1.nas.gov/nasarchitecture/>.

<sup>24</sup> Carlock and Fenton, 243-254.

<sup>25</sup> Ibid., 260.

<sup>26</sup> Cooper et al. (2001), 362.

<sup>27</sup> Cooper et al. (2000), 27-32.

<sup>28</sup> Cooper et al. (2001), 378.

<sup>29</sup> Waldrop, 4-23.

## *Glossary*

AF—Air Force

AFPD—Air Force Policy Directive

AFROCC—Air Force Requirements for Operational Capabilities Council

AFMC—Air Force Materiel Command

AFSPC—Air Force Space Command

Architecture—the structure of components, their relationships, and the principles and guidelines governing their design and evolution over time

C4ISR—Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance

Capability—an ability to perform or execute a course of action to a desired level of accomplishment

Capability Package—same as Mission Capability Package (MCP)

CIO—Chief Information Officer

CJCS—Chairman of the Joint Chiefs of Staff

CONOPS—Concept of Operations

CRRA—Capabilities Review and Risk Assessment

CSAF—Chief of Staff of the Air Force

Disconnect—a type of programming action that provides funds needed to reconcile a problem or shortfall to make a program fully executable

DoD—Department of Defense

EBO—Effects-Based Operations—actions taken against enemy systems designed to achieve specific effects that contribute directly to desired military and political outcomes

Effects—a full range of outcomes, events, or consequences that result from a specific action

Effects-Based—action taken with the intent to produce a distinctive and desired effect

HQ—Headquarters

IER—Information Exchange Requirement

Initiative—a type of programming action that funds a new project or a new portion of an existing project

ISR—Intelligence, Surveillance and Reconnaissance

Joint Mission Area—a functional group of joint tasks and activities that share a common purpose and facilitate the operation and interoperability of joint forces

Joint Operational Architecture—a description of tasks and activities, operational elements, and information flows required to accomplish or support military operations; intended to represent the entire spectrum of joint operations, subdivided into Joint Mission Areas

JROC—Joint Requirements Oversight Council

MAJCOM—Major Command

MAP—Mission Area Plan

MCP—Mission Capability Package—a task-organized, integrated approach to accomplishing a focused operational mission or task (e.g., time-sensitive targeting), that includes a concept of operations, command approach, organization, systems (sensor, weapon, command and control, networks), processes and appropriately skilled personnel

Mission Area Integrated Architecture—a family-of-systems or system-of-systems architecture for a particular mission or sub-mission, consisting of three correlated “views” (operational view, systems view, technical view)

NRO—National Reconnaissance Office

Offset—a type of programming action that enables money to be taken from a current project to help pay for other projects; for instance, delaying, killing, or adjusting the content of a program

Operational View—describes tasks and activities, operational elements, and information flows for an architecture

OSD—Office of the Secretary of Defense

PA&E—Program Analysis and Evaluation

POM—Program Objective Memorandum

PPBS—Planning, Programming and Budgeting System

QAPR—Quarterly Acquisition Program Review

RAPIDS—Resource Allocation Programming Information Decision System

SBIRS—Space Based Infrared System

SMP—Strategic Master Plan

SoS—System of Systems

Systems View—describes the systems and system interfaces supporting the operational nodes of an architecture

Technical View—lists the standards and rules governing interdependence of system parts or elements within an architecture

Trade Space—a set of projects or programs ranked close to a “funding cutoff line” at a given level of the Air Force corporate process (including candidate offsets); likely to be elevated to the next higher level for further assessments and AF-wide balancing

USAF—United States Air Force

USD(AT&L)—Undersecretary of Defense for Acquisition, Technology, and Logistics

USecAF—Undersecretary of the Air Force

VCJCS—Vice Chairman of the Joint Chiefs of Staff

## ***Bibliography***

- Air Combat Command. *Global Strike Task Force CONOPS*. Version 2.0, ACC/XPS: 26 July 2002. On-line. Internet, 2 December 2002. Available from <https://afconops.hq.af.mil/support/index3.htm>.
- Air Force Policy Directive (AFPD) 10-28. *CONOPS Development*, 8 January 2002.
- Air Force Space Command. *Strategic Master Plan FY04 and Beyond*. Peterson AFB, CO: AFSPC/PA, 5 November 2002. On-line. Internet, 13 December 2002. Available from <http://www.spacecom.af.mil/hqafspc/library/AFSPCPAOffice/Final%2004%20SMP--Signed!.pdf>.
- Alberts, David S., John J. Gartska, and Frederick P. Stein. *Network Centric Warfare: Developing and Leveraging Information Superiority*. 2<sup>nd</sup> Ed., Revised, Washington DC: DoD C4ISR Cooperative Research Program, August 1999. On-line. Internet, 13 December 2002. Available from <http://www.dodccrp.org/>.
- Aldridge, Edward C. "Pete." "DoD USD(AT&L) 'All Hands'." *Program Manager* (September-October 2002): 66-72.
- Carlock, Paul G., and Robert E. Fenton. "System of Systems (SoS) Enterprise Systems Engineering for Information-Intensive Organizations." *Systems Engineering* 4, no. 4 (2001): 242-261.
- Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01B. *Requirements Generation System*, 15 April 2001.
- Cooper, Robert G., Scott J. Edgett, and Elko J. Kleinschmidt. "New Problems, New Solutions: Making Portfolio Management More Effective." *Research · Technology Management* (March-April 2000): 18-33.
- Cooper, Robert, Scott Edgett, and Elko Kleinschmidt. "Portfolio management for new product development: results of an industry practices study." *R&D Management* 31, no. 4 (2001): 361-380.
- Davis, Paul K. *Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation*. RAND Report MR-1513-OSD. Santa Monica, CA: RAND, 2002. On-line. Internet, 18 November 2002. Available from <http://www.rand.org/publications/MR/MR1513/>.
- Department of Defense. *Quadrennial Defense Review Report*. Washington, DC: Office of the Secretary of Defense, 30 September 2001.
- Department of Defense Instruction (DODI) 4630.8. *Procedures for Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)*, 2 May 2002.
- Deputy Secretary of Defense. Memorandum. Subject: Defense Acquisition, 30 Oct 2002. Attachment 2, "Operation of the Defense Acquisition System." On-line. Internet, 14 December 2002. Available from <http://dod5000.dau.mil>.

- DoD Architecture Framework Working Group. *DoD Architecture Framework Version 1.0, Volumes I-III* (Draft), 1 October 2001. On-line. Internet, 14 December 2002. Available from <http://www.cc.hq.af.mil/ST/DODAFv1.pdf> to <http://www.cc.hq.af.mil/ST/DODAFv3.pdf>.
- Donnelly, John M. "Pentagon Weighs How To Budget For Interoperability." *Space & Missile Defense Report* (14 November 2002): 2.
- Greer, Thomas H. *The Development of Air Doctrine in the Army Air Arm 1917-1941*. 1955. Reprint, Washington, DC: Office of Air Force History, 1985.
- Grossman, Elaine M. "Air Force Creates New Process to Review Warfighting Capabilities." *Inside the Pentagon* (21 March 2002), n.p. Copy provided by author.
- Grossman, Elaine M. "Air Force Remodels Oversight Process for 'Capabilities-Based' Tack." *Inside the Pentagon* (11 April 2002), n.p. Copy provided by author.
- Grossman, Elaine M. "Air Force to Name Seven Colonels to 'Champion' Key Task Forces." *Inside the Pentagon* (21 February 2002), n.p. Copy provided by author.
- Hamilton, Doug. "Linking strategic information systems concepts to practice: systems integration at the portfolio level." *Journal of Information Technology* 14 (1999): 69-82.
- Hawkins, Maj Gen James A., vice director, Joint Staff. Memorandum, DJSJ-0921-02. Subject: Changes to the Requirements Generation System, 7 October 2002. On-line. Internet, 14 December 2002. Available from <http://dod5000.dau.mil/3170%20memo.pdf>.
- Hillestad, Richard J., and Paul K. Davis. *Resource Allocation for the New Defense Strategy: The DynaRank Decision-Support System*. RAND Report MR-996-OSD. Santa Monica, CA: RAND, 1998. On-line. Internet, 18 November 2002. Available from <http://www.rand.org/publications/MR/MR996/>.
- Jumper, Gen John P., chief of staff, US Air Force. "Chief's Sight Picture: Capabilities Review and Risk Assessment." 11 February 2002, n.p. On-line. Internet, 25 September 2002. Available from [http://www.af.mil/lib/sight/sight\\_11feb02.pdf](http://www.af.mil/lib/sight/sight_11feb02.pdf).
- Kent, Glenn A., and David A. Ochmanek. *A Framework for Modernization*. Draft RAND Project Air Force Report DRR-2629-1-AF. Washington, DC: RAND, June 2002.
- Kostoff, Ronald N., Robert Miller, and Rene Tshiteya. "Advanced technology development program review – a US Department of the Navy case study." *R&D Management* 31, no. 3 (2001): 287-298.
- Levis, Alexander H., et al. Briefings from C4ISR Architecture Framework Implementation Course. Langley AFB, VA, May 2002. On-line. Internet, 14 December 2002. Available from <http://www.cc.hq.af.mil/ST/>.
- Lewis, Leslie, Roger Allen Brown, and C. Robert Roll. *Service Responses to the Emergence of Joint Decisionmaking*. RAND Report MR-1438-AF. Santa Monica, CA: RAND, 2001. On-line. Internet, 25 January 2003. Available from <http://www.rand.org/publications/MR/MR1438/>.
- Mara, CDR Mike. "Integration and Interoperability through Operational Concepts and Architectures." Briefing presented at the 2002 DoD Interoperability Conference. Mesa, AZ, 26 March 2002. On-line. Internet, 14 December 2002. Available from <http://www.dtic.mil/ndia/2002interop/mara.pdf>.
- "Materiel Provider QA: Interview with Gen. Lester L. Lyles." *Military Aerospace Technology* 1, no. 3 (July 2002), n.p. On-line. Internet, 13 December 2002. Available from [http://www.mat-kmi.com/Archives/1\\_3\\_MAT/1\\_3\\_QA.cfm](http://www.mat-kmi.com/Archives/1_3_MAT/1_3_QA.cfm).

- Parnell, Dr. Gregory S., et al. "Foundations 2025: A Value Model for Evaluating Future Air and Space Forces." *Management Science* 44, no. 10 (October 1998): 1336-1350.
- Parnell, Gregory S., et al. "Multiple Perspective R&D Portfolio Analysis for the National Reconnaissance Office's Technology Enterprise." *Military Operations Research* 6, no. 3 (2001): 19-34.
- Poh, K. L., B. W. Ang, and F. Bai. "A comparative analysis of R&D project evaluation methods." *R&D Management* 31, no. 1 (2001): 63-75.
- President. *The National Security Strategy of the United States of America*. Washington DC: The White House, September 2002.
- Sowell, P. Kathie. "The C4ISR Architecture Framework: History, Status, and Plans for Evolution." Paper presented at the 5<sup>th</sup> International Command and Control Research and Technology Symposium, Canberra, Australia, October 2000. On-line. Internet, 21 October 2002. Available from <http://www.dodccrp.org/2000ICCRTS/cd/papers/Track7/067.pdf>.
- Waldrop, M. Mitchell. "Control Without Control: From Complexity to the Management of Innovation." Seminar presentation for the joint RAND and Woodrow Wilson Center project on Complexity and Public Policy, 2002. On-line. Internet, 19 December 2002. Available from <http://www.complexityandpolicy.org/dial.htm>.
- Westphal, Deborah L., Richard Szafranski, and Dr. Gregory S. Parnell. "Strategic Planning for the Air Force." *Airpower Journal* (Winter 1998): 29-40.
- Yurchak, CAPT John. "Battle Force Capabilities / Mission Capability Packages." Briefing presented at Navy Interoperability Workshop. Crystal City, VA, 30 May 2001. On-line. Internet, 14 December 2002. Available from <http://www.dtic.mil/ndia/2001interop/yurchak.pdf>.